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VOLUME 12, NUMBER 14
JULY 15, 1979

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SELECTED WATER RESOURCES ABSTRACTS

A Semimonthly Publication of the Water Resources Scientific Information Center, Office of Water Research and Technology, U.S. Department of the Interior

VOLUME 12, NUMBER 14
JULY 15, 1979

W79-06501--W79-07000

The Secretary of the U.S. Department of the Interior has determined that the publication of the periodical is necessary in the transaction of the public business required by law of this Department. Use of funds for printing this periodical has been approved by the Director of the Office of Management and Budget through August 31, 1983.

As the Nation's principal conservation agency, the Department of the Interior has responsibility for most of our nationally owned public lands and natural resources. This includes fostering the wisest use of our land and water resources, protecting our fish and wildlife, preserving the environmental and cultural values of our national parks and historical places, and providing for the enjoyment of life through outdoor recreation. The Department assesses our energy and mineral resources and works to assure that their development is in the best interests of all our people. The Department also has a major responsibility for American Indian reservation communities and for people who live in Island Territories under U.S. administration.

FOREWORD

Selected Water Resources Abstracts, a semimonthly journal, includes abstracts of current and earlier pertinent monographs, journal articles, reports, and other publication formats. The contents of these documents cover the water-related aspects of the life, physical, and social sciences as well as related engineering and legal aspects of the characteristics, conservation, control, use, or management of water. Each abstract includes a full bibliographical citation and a set of descriptors or identifiers which are listed in the **Water Resources Thesaurus.** Each abstract entry is classified into 10 fields and 60 groups similar to the water resources research categories established by the Committee on Water Resources Research of the Federal Council for Science and Technology.

WRSIC IS NOT PRESENTLY IN A POSITION TO PROVIDE COPIES OF DOCUMENTS ABSTRACTED IN THIS JOURNAL. Sufficient bibliographic information is given to enable readers to order the desired documents from local libraries or other sources.

Selected Water Resources Abstracts is designed to serve the scientific and technical information needs of scientists, engineers, and managers as one of several planned services of the Water Resources Scientific Information Center (WRSIC). The Center was established by the Secretary of the Interior and has been designated by the Federal Council for Science and Technology to serve the water resources community by improving the communication of water-related research results. The Center is pursuing this objective by coordinating and supplementing the existing scientific and technical information activities associated with active research and investigation program in water resources.

To provide WRSIC with input, selected organizations with active water resources research programs are supported as "centers of competence" responsible for selecting, abstracting, and indexing from the current and earlier pertinent literature in specified subject areas.

Additional "centers of competence" have been established in cooperation with the Environmental Protection Agency. A directory of the Centers appears on the inside back cover.

Supplementary documentation is being secured from established discipline-oriented abstracting and indexing services. Currently an arrangement is in effect whereby the BioScience Information Service of Biological Abstracts supplies WRSIC with relevant references from the several subject areas of interest to our users. In addition to Biological Abstracts, references are acquired from Bioresearch Index which are without abstracts and therefore also appear abstractless in SWRA. Similar arrangements with other producers of abstracts are contemplated as planned augmentation of the information base.

The input from these Centers, and from the 51 Water Resources Research Institutes administered under the Water Resources Research Act of 1964, as well as input from the grantees and contractors of the Office of Water Research and Technology and other Federal water resource agencies with which the Center has agreements becomes the information base from which this journal is, and other information services will be, derived; these services include bibliographies, specialized indexes, literature searches, and state-of-the-art reviews.

Comments and suggestions concerning the contents and arrangements of this bulletin are welcome.

Water Resources Scientific Information Center
Office of Water Research and Technology
U.S. Department of the Interior
Washington, DC 20240

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01 NATURE OF WATER
Includes the following Groups: Properties; Aqueous Solutions and Suspensions

02 WATER CYCLE
Includes the following Groups: General; Precipitation; Snow, Ice, and Frost; Evaporation and Transpiration; Streamflow and Runoff; Groundwater; Water in Soils; Lakes; Water in Plants; Erosion and Sedimentation; Chemical Processes; Estuaries.

03 WATER SUPPLY AUGMENTATION AND CONSERVATION
Includes the following Groups: Saline Water Conversion; Water Yield Improvement; Use of Water of Impaired Quality; Conservation in Domestic and Municipal Use; Conservation in Industry; Conservation in Agriculture.

04 WATER QUANTITY MANAGEMENT AND CONTROL
Includes the following Groups: Control of Water on the Surface; Groundwater Management; Effects on Water of Man's Nonwater Activities; Watershed Protection.

05 WATER QUALITY MANAGEMENT AND PROTECTION
Includes the following Groups: Identification of Pollutants; Sources of Pollution; Effects of Pollution; Waste Treatment Processes; Ultimate Disposal of Wastes; Water Treatment and Quality Alteration; Water Quality Control.

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07 RESOURCES DATA
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09 MANPOWER, GRANTS, AND FACILITIES
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10 SCIENTIFIC AND TECHNICAL INFORMATION
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SUBJECT INDEX

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ACCESSION NUMBER INDEX

ABSTRACT SOURCES

SELECTED WATER RESOURCES ABSTRACTS

1. NATURE OF WATER

1A. Properties

PUBLIC GROUNDWATER SUPPLIES IN MORGAN AND SCOTT COUNTIES,
Illinois State Water Survey, Urbana.
For primary bibliographic entry see Field 7C.
W79-06768

PUBLIC GROUNDWATER SUPPLIES IN PIKE COUNTY,
Illinois State Water Survey, Urbana.
For primary bibliographic entry see Field 7C.
W79-06769

2. WATER CYCLE

2A. General

UTILIZATION AND INTERPRETATION OF HYDROLOGIC DATA WITH SELECTED EXAMPLES FROM NEW HAMPSHIRE,
New Hampshire Univ., Durham. Water Resource Research Center.
For primary bibliographic entry see Field 7A.
W79-06502

THE WATER BUDGET AND POTENTIAL WATER RESERVES OF THE EAST AFRICA SOURCE REGION OF THE NILE,
McGill Univ., Montreal (Quebec). Dept. of Meteorology.
E. Vowinckel, and S. Orvig.
Journal of Applied Meteorology, Vol. 18, No. 2, p 148-155, February 1979. 2 fig, 8 tab, 7 ref, 1 append.

Descriptors: *Hydrologic budget, *Africa, *Potential water supply, *Water resources, Rivers, Lakes, Watersheds(Basins), Rainfall, Precipitation(Atmospheric), Runoff, Evaporation, Swamps, Land use, Irrigation, Agriculture, Vegetation, Vegetation effects, Radiation, Solar radiation, Evapotranspiration, Model studies, Hydrology, Effects, Meteorology, Climatology, *Nile River.

An energy budget model was used, with daily synoptic surface and upper air data from 4 stations in East Africa, to calculate all terms of the surface energy balance once for each day and each night of 1973. The calculated evaporation was combined with precipitation values to give estimates of water surplus or deficit for a variety of natural regions. The surface included is the main source region of the White Nile, the study comprising the drainage area down to Nimule on the border of Sudan. The average outflow there is about 22 x 10 to the 9th power cu m/year, and the investigation attempted to estimate the effects on this outflow, and the amount of water potentially available for irrigation, by chaning certain surface parameters in the energy budget model. These surface parameters described the vegetation density, the soil types as characterized by water holding capacity, and surface slope. Lake Victoria is sufficiently large to generate its own air circulation and a precipitation maximum. Nevertheless, the lake does not enhance the regional outflow because of the high evaporation rate. The smaller lakes have substantial negative water budgets, as would be the case for all man-made reservoirs. The mountain regions contribute more than 60% of the total annual runoff from the land area. By a number of changes in the surface parameters in the model, a series of estimated values were obtained of the water potentially available for irrigation and the resulting altered outflow in the Nile at Nimule. (Sims-ISWS)
W79-06591

EQUATIONS OF VOLUME AND SALT BALANCES OF BRINE PONDS,
Moscow Highway Inst. (USSR).
N. A. Kartvelishvili, and S. S. Remizova.
Water Resources, Vol. 4, No. 6, p 935-940, November-December 1977. 3 fig, 10 ref. Translated from Vodnye Resursy, No. 6, p 168-173, November-December 1977.

Descriptors: *Brines, *Ponds, *Model studies, Mathematical models, Salts, Water balance, Salt balance, Precipitation(Atmospheric), Evaporation, Storage, Underground storage, Mathematics, Monte Carlo method, Equations, Brine ponds, Salt dilution.

In the 1950s in the USA and later in England, France, USSR, and other countries, the method of storing petroleum, petroleum products, and gas in underground storage reservoirs leached out in rock-salt deposits began to be developed. The product stored in the reservoirs is displaced by a salt solution, for the preparation and storage of which open surface brine ponds are created. For normal operation of underground reservoirs and to avoid their dissolution and collapse, the brine pond should contain a required volume of solution of a certain concentration during the entire year, regardless of the weather conditions. However, as was shown by investigations conducted on experimental industrial brine ponds and in special open storages, the solution stored under various climatic conditions in the Tadzhik, Ukrainian, and Armenian SSR, and also near the city of Valdai, during the year undergoes considerable changes both in volume and in concentration of salts as a consequence of freezing, evaporation, precipitation of salt, dilution by atmospheric precipitation, etc. In this case, the salt concentration on the surface of the brine pond varies from the initial concentration of 318 g/liter required for operation to 5-10 g/liter with considerable vertical stratification. The concentration and volume of the solution in the brine pond can be controlled by adding new portions of solution. To determine the additional volume of solution and its concentration, it is necessary to solve the equations of the volume and salt balances of the brine pond. (Sims-ISWS)
W79-06611

TERRITORIAL DISTRIBUTION OF THE RELATIONSHIPS BETWEEN COMPONENTS OF WATER AND HEAT BALANCES,
Akademiya Nauk SSSR, Moscow. Inst. Vodnykh Problem.
V. V. Kulakov, and E. I. Breslav.
Water Resources, Vol 4, No 6, p 821-827, November-December 1977. 4 fig, 1 tab, 12 ref. Translated from Vodnye Resursy, Vol 6, p 29-37, November-December 1977.

Descriptors: *Heat balance, *Water balance, *Distribution patterns, Precipitation(Atmospheric), Moisture, Evaporation, Radiation, Solar radiation, Heat, Heat transfer, Analytical techniques, *USSR.

A rather distinct regularity was observed in the territorial distribution of components of water and heat balances. This regularly is due mainly to the zonal character of the distribution of the incoming short-wave solar radiation and precipitation. The effect of other physiographic factors on the normal distribution of components of water and heat balances is comparatively small. This makes it possible to construct generalized relations for large territories between precipitation, evaporation, and maximum possible precipitation, which is determined mainly by the radiation balance. The purpose of this work was to determine these relations for the plains of the European and Asiatic territories of the USSR. (Sims-ISWS)
W79-06616

SIMULATED STREAMFLOW RESPONSE TO POSSIBLE DIFFERENCES IN TRANSPIRATION AMONG SPECIES OF HARDWOOD TREES,
Northeastern Forest Experiment Station, Durham, NH.
C. A. Federer, and D. Lash.
Water Resources Research, Vol. 14, No. 6, p 1089-1097, December, 1978. 8 fig, 4 tab, 17 ref.

Descriptors: *Streamflow, *Transpiration, Hydrologic cycle, Model studies, Simulation analysis, Hardwood, Forest watersheds, Watershed management, Evapotranspiration.

Possible differences in transpiration among species of hardwood trees were simulated in a hydrologic model, called Brook, to estimate the effects of these differences on monthly and annual streamflow. Brook is a deterministic, lumped-parameter model that simulated streamflow from small, forested watersheds in the eastern United States. The model uses only daily mean temperature and daily precipitation as input. A 4-week difference in timing of leaf-development in spring or color change in autumn caused differences of 10-60 mm in simulated annual streamflow. When daily transpiration varied by 20%, as it might with differences in leaf diffusive resistance among species, differences in simulated streamflow ranged from 15 to 120 mm annually. Differences in root distribution with depth can affect the availability of soil water; varying this availability caused differences in simulated streamflow of 15-60 mm. In all cases the smaller differences occurred when the soil was dry at the time of differing transpiration. On a deep residual soil the differences in streamflow were spread through the year, but on a shallow till soil the differences were restricted to the months in which there were changes in transpiration. Differenences in response among 15 degrees north-facing and 15 degrees south-facing slopes and a horizontal surface were minor. (Skogerboe-Colorado State)
W79-06705

RATES OF WEATHERING AND SOIL FORMATION ON GRANITE IN RHODESIA,
Science and Education Administration, Coschocton, OH.
L. B. Owens, and J. P. Watson.
Soil Science Society of America Journal, Vol. 43, No. 1, p 160-166, January-February 1979. 7 fig, 7 tab, 30 ref.

Descriptors: *Weathering, *Watersheds(Basins), *Africa, *Soil surveys, *On-site investigations, Geomorphology, Soils, Water quality, Runoff, Soil formation, Soil analysis, Geochemistry, Rocks, Analysis, Calcium, Sodium, Potassium, Magnesium, Aluminum, Silica, Cations, Streamflow, Rain water, Sands, Silts, Clays, Hydrogen ion concentration, Soil horizons, Foreign countries, Foreign research, *Rhodesia, *Rusape watershed(Rhodesia), *Juliasdale watershed(Rhodesia).

Rates of weathering and soil formation on granite were studied in two areas of Rhodesia using small watersheds. The Juliasdale watershed of 0.91 sq km is hilly and has a mean annual rainfall of 1,220 mm. The Rusape watershed of 7.33 sq km is more nearly level and has a mean annual rainfall of 920 mm. Streamflow was measured in the two catchments over a period of at least 7 years. Streamwater, rainwater, soil, and rock samples were analyzed for Ca, Mg, K, Na, Si, and Al. The rate of granite weathering was calculated using Barth's equation which links the rate of weathering to the amount of an element removed in solution per unit time, its concentration in the rock, and its concentration in the weathered product. Sodium and Ca were the elements used in the Barth equation. The weathering rates in the Juliasdale and Rusape watersheds were estimated at 400 and 150 kg/ha per year, respectively, or 15.4 and 5.8 mm/1000 years. The concepts of C. E. Marshall and J. F. Haseman as well as S. W. Buol include changes in bulk density during the weathering process and give soil formation rates more acceptable than those of Barth. Thus, the rate of soil formation was found to be 11.0 mm/1000 years in the Juliasdale watershed and 4.1 mm/1000 years in the Rusape watershed. (Humphreys-ISWS)
W79-06741

EXPERIMENTAL NUMERICAL SIMULATION OF UNSTEADY WATER FLOW IN A MULTI-BRANCH RIVER DELTA,
For primary bibliographic entry see Field 2L.
W79-06749

Group 2A—General

WATER RESOURCES OF THE POTOMAC RIVER BASIN, WEST VIRGINIA,
Geological Survey, Morgantown, WV. Water Resources Div.
For primary bibliographic entry see Field 6D.
W79-06813

THE MAKING OF DESERTS: CLIMATE, ECOLOGY, AND SOCIETY,
Toronto Univ. (Ontario).; Clark Univ., Worcester, MA.; and University Coll., London (England).
K. F. Hare, R. W. Kates, and A. Warren.
Economic Geography, Vol. 53, No. 4, p 332-346, Oct. 1977. 3 fig, 56 ref.

Descriptors: *Desertification, *Irrigation effects, *Biodegradation, *Social impact, *Environmental effects, *Balance of nature, Droughts, Ecosystems, Comprehensive planning, Social aspects, Climatology, Social function, Human resources, Climatic data, Variability, Planning, Arid lands.

The multi-faceted and intricately interwoven nature of the processes of desertification have long complicated attempts to unravel their causes from their effects. Three fundamental questions emerge in this endeavor: (1) to what degree is the inherent variability of climate, possibly coupled with climatic change and human activity, responsible for desertification, (2) can the ecological evidence for desertification be untangled from a morass of observational problems, temporal uncertainties as to trend, and ambiguities as to the areal extent of afflicted regions, and (3) what are the human dimensions, the causal mechanisms and the human impacts, of desertification. Water resource development has for long been hampered by the extreme climatic variability inherent to the arid regions and contemporary desertification is the result of this variability, including drought cycles, and the increasing pressures exerted by man upon the land and vegetation. Agricultural endeavors, both irrigated and rainfed, have frequently upset the precarious balance of nature in many of the worlds deserts, with waterlogging and increasing salinity resulting. Emphasis is placed by these authors, upon the needs to understand and cope with desertification, to minimize the ecological impact of resource use to avoid contributing to these destructive processes and to assist individuals and groups affected by desertification. Accordingly, the corrective measures offered here take many forms, but all stem from a concern for human systems as the central focus of desertifications causes and consequences. (Tickes-Arizona)
W79-06839

SUPPLYING DATA TO USERS,
Department of Fisheries and Environment, Ottawa (Ontario). Inland Waters Directorate.
W. J. Ozga.
Technical Bulletin No. 111, 1979, 21 p.

Descriptors: *Streamflow, *Water levels, *Sediments, Data storage and retrieval, Basic data collections.

This publication contains a description of the various types of streamflow, water level, and sediment data that are available and how they can be requested. (WATDOC)
W79-06853

PHYSICAL-GEOGRAPHIC AND HYDROLOGIC DESCRIPTION OF THE TEST SITE IN THE USSR (MOUNTAIN REGION OF THE SYRDAR'YA RIVER BASIN IN THE NORTHERN PART OF THE FERGANA DEPRESSION) AND DATA ON GROUND HYDROLOGIC, METEOROLOGIC, AND ACTINOMETRIC MEASUREMENTS,
Available from the National Technical Information Service, Springfield, VA 22161 as N77-18537, Price codes: A03 in paper copy, A01 in microfiche.
NASA Technical Translation F-17,523, February 1977. 48 p, 9 fig, 10 tab, 7 ref. Translation by Leo Kanner Associates, Redwood City, California. NASA 2790.

Descriptors: *Drainage, *Rivers, *Streamflow, *Mountains, Soils, Watersheds(Basins), Geology, Vegetation, Snowfall, Rainfall, Precipitation(Atmospheric), Runoff, Snow, Snow cover, Snow melt, Evaporation, Discharge(Water), Hydrology, *USSR.

Mountain configuration, elevation distribution, river patterns, soil types, and irrigation systems were described for the test site (mountain region of the Syrdar'ya River basin in the northern part of the Fergana Depression). Mean-diurnal, mean-monthly, and mean-multiannual discharge data were given for the flows of the most important rivers. Springs and streams were described as to their numbers and total yield. Typical vegetation in the various soils was described by region. (Sims-ISWS)
W79-06878

SUPPORT OBSERVATIONS FOR WEATHER MODIFICATION OPERATIONS IN THE SAN JUAN MOUNTAINS AND A PROCEDURE FOR ESTIMATING SNOWPACK RUNOFF,
Western Weather Consultants, Inc., Durango, CO.
L. M. Hjermstad, and R. A. Mendenwaldt.
Final Report No. WWCI FR-003, January 1979. 46 p, 3 fig, 7 tab, 6 ref, 1 append. 7-07-83-V0005.

Descriptors: *Precipitation(Atmospheric), *Meteorology, *Weather data, *Weather modification, *Cloud seeding, *Snowpacks, *Snowmelt, Runoff, Runoff forecasting, Streamflow forecasting, Rainfall, Rainfall intensity, Rain gages, San Juan Mountains(Colorado), Environmental Data Network.

Surface precipitation measurements from the San Juan Mountains of Southwestern Colorado were obtained to expand and continue the Project Skywater data base for precipitation measurements. Field work involved the calibration, installation, weekly collection of the data, and maintenance of six recording precipitation gages. The data obtained were reduced, quality checked, and put into a computer compatible format. The usefulness of the Bureau of Reclamation's Environmental Data Network (EDN) was evaluated for cloud seeding operations. The most limiting constraint of the EDN was the availability of data at a consistent time. The programs available on the EDN were extremely valuable for evaluating weather modification potential. Wintertime precipitation and runoff relationships in the San Juan Mountains were analyzed and an equation was developed which could forecast by mid-May the runoff from the winter's snowpack to within 5% of the actual runoff observed. (Davison-IPA)
W79-06940

2B. Precipitation

SATELLITES AS AN AID TO WATER RESOURCE MANAGERS,
National Environmental Satellite Service, Washington, DC.
For primary bibliographic entry see Field 2C.
W79-06505

GUIDELINES FOR FLASH FLOOD AND SMALL TRIBUTARY FLOOD PREDICTION,
National Oceanic and Atmospheric Administration, Washington, DC. Div. of Scientific Service.
L. A. Hughes, and L. L. Longsdorf.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-281 461, Price codes: A02 in paper copy, A01 in microfiche.
NOAA Technical Memorandum NWS CR-58, Revised, March 1978. 11 p, 2 fig, 2 append.

Descriptors: *Precipitation(Atmospheric), *Flood forecasting, *Flash floods, *Thunderstorms, *Radar, *Rainfall intensity, Precipitation intensity, Weather forecasting, Tributaries, Basins, Regions, Central US, Warning systems, Streamflow forecasting, Regional flood, Watersheds(Basins).

A structured step-by-step approach to determining the threat and extent of flash floods in the Central Region is presented. Heavy rain threat areas and the flash flood watch, estimating the flood and issuing the flash flood warning, the use of radar data during threatening thunderstorms, the use of radar and storm spotter reports, and determining the area of the stream basin involved in the storm are discussed. (Davison-IPA)
W79-06563

A STUDY OF RAINFALL PATTERN IN RELATION TO CROP PLANNING OVER THE HARYANA STATE,
Haryana Agricultural Univ., Hissar (India).
O. P. Bishnoi, and K. K. Saxena.
Indian Journal of Meteorology, Hydrology and Geophysics, Vol 29, No 3, p 501-507, July 1978. 7 fig, 2 tab, 1 ref.

Descriptors: *Rainfall, *Distribution patterns, *Crops, Precipitation(Atmospheric), Climates, Weather, Variability, Monsoons, Climatic zones, Climatology, Meteorology, Agriculture, *India, *Haryana State(India).

Haryana State receives a range of 200 to 1200 mm of annual rainfall in 7 agroclimatic zones. The rainfall patterns of these zones were discussed, with special reference to the amount, variation, and probabilities based on the rainfall data of the rain-recording stations. The existing cropping patterns were analyzed at block level in relation to rainfall pattern, variability, etc. (Sims-ISWS)
W79-06586

ON THE CONCENTRATION OF SULFATE IN PRECIPITATION,
Battelle Pacific Northwest Labs., Richland, WA.
For primary bibliographic entry see Field 5B.
W79-06592

STATISTICS OF RAINFALL OVER PATHS FROM 1 TO 50 KM,
Politecnico di Milano (Italy).
G. Drufuca, and R. R. Rogers.
Atmospheric Environment, Vol. 12, No. 12, p 2333-2342, 1978. 9 fig, 8 tab, 15 ref, 2 append.

Descriptors: *Rainfall, *Statistics, *Model studies, Mathematical models, Weather data, Precipitation(Atmospheric), Storms, Distribution patterns, Spatial distribution, Rain gages, Probability, Rainfall disposition, Rainfall intensity, Weather, Meteorology, Rainfall over paths, Path length.

Ten years of data from the tipping-bucket raingage of the McGill Observatory, Montreal, were analyzed using the synthetic storm technique to generate statistics of rain along paths ranging from 1 to 50 km in length. For each rain event and for every path length considered, the mean and mean-square rain rate were calculated. These were then employed to obtain the standard deviation and the uniformity of the rain for each event and every path. Probability distributions of these quantities were compiled, and their dependence on path length was noted. The tendency for uniform structure is strong on short paths, but it decreases with increasing path length. Probability distributions of rain rate were calculated for paths of various lengths, conditioned by the path-average rate. These distributions can be used in applications in which there is a nonlinear dependence on rainfall rate, such as electromagnetic interactions with rain and the scavenging of pollutants. For paths up to 10 km in length, the modal value of rain rate was found to be equal to the path-average rate for all combinations of path length and average rate. With increasing path length, a second mode corresponding to zero rain rate or very weak rain becomes increasingly important and eventually dominant. Approximately half of the total variance of spatial fluctuations in rain rate is accounted for by scales shorter than 8 km. (Sims-ISWS)
W79-06603

TERRITORIAL DISTRIBUTION OF THE RELATIONSHIPS BETWEEN COMPONENTS OF WATER AND HEAT BALANCES,
Akademiya Nauk SSSR, Moscow. Inst. Vodnykh Problem.
For primary bibliographic entry see Field 2A.
W79-06616

SOIL MOISTURE VARIATION UNDER BARE CONDITIONS AT PUNE AND DELHI IN RELATION TO RAINFALL,
Meteorological Office, Poona (India).
For primary bibliographic entry see Field 2G.
W79-06750

STATISTICAL DISTRIBUTION OF DIFFERENT CUMULATIVE PERIODS OF RAINFALL IN HARYANA,
Haryana Agricultural Univ., Hissar (India).
O. P. Bishnoi, and K. K. Saxena.
Indian Journal of Meteorology, Hydrology and Geophysics, Vol 29, No 3, p 528-534, July 1978. 5 fig, 2 tab, 8 ref.

Descriptors: *Rainfall, *Distribution, *Statistics, Precipitation(Atmospheric), Distribution patterns, Curves, Frequency curves, Histograms, Equations, Probability, Agriculture, Crops, Monsoons, Meteorology, Climatology, *India, *Haryana State(India).

The statistical distribution of the accumulated rainfall for one, two, three, four, six, eight and sixteen weeks commencing from the onset of the southwest monsoon (25th standard week) was studied in respect of a low rainfall station, Hissar, and high rainfall station, Ambala in the Haryana State. The study of rainfall distribution indicated that up to a cumulative period of four weeks skewness is very high and, therefore, normal distribution cannot be fitted. In such cases gamma distribution was fitted and found satisfactory. Whereas beyond four weeks cumulative period, normal distribution was found satisfactory. Probability charts were prepared using the theoretical distribution to study their behavior with respect to crop planning. (Sims-ISWS)
W79-06752

CHARACTERISTICS OF SHORT PERIOD RAINFALL IN GUJARAT,
Meteorological Office, Poona (India).
N. N. Khambete, and B. C. Biswas.
Indian Journal of Meteorology, Hydrology and Geophysics, Vol. 29, No. 3, p 521-527, July 1978. 3 fig, 4 tab, 4 ref.

Descriptors: *Rainfall, *Distribution patterns, *Variability, Temporal distribution, Spatial distribution, Precipitation(Atmospheric), Frequency, Monsoons, Crops, Agriculture, Climatology, Meteorology, *India, *Gujarat State(India), Short-period rainfall.

Weekly rainfall of 30-70 years for one station in each of 15 districts in the dry land tract of Gujarat State was studied. The assured amounts of rainfall that may be expected to be exceeded in 30 and 50% of the years were shown. The distribution of dry and wet weeks during the monsoon season was examined. In general, the number of wet weeks varied from 2 to 12 in each year during the monsoon season and the remaining were dry weeks. The average number of wet weeks increased from west to east. The mean length of a wet spell also increased from 2 weeks at Bhuj to 3 weeks at Dohad. Mean length of a dry spell in monsoon varied from 3 to 2 weeks. (Sims-ISWS)
W79-06753

MAJOR CLIMATOLOGICAL DISCONTINUITIES IN THE MONTHLY MONSOON ACTIVITY IN THE NEIGHBORHOOD OF THE WESTERN GHATS,
Institute of Tropical Meteorology, Poona (India).
D. A. Mooley.
Indian Journal of Meteorology, Hydrology and Geophysics, Vol 29, No 3, p 508-514, July 1978. 1 fig, 3 tab, 2 ref.

Descriptors: *Rainfall, *Temporal distribution, *Distribution patterns, Networks, Rain gages, Precipitation(Atmospheric), Monsoons, Climates, Variability, Mountains, Effects, Meteorology, Climatology, *India, *Western Ghats(India), Climatological discontinuities.

The major climatological discontinuities in the monsoon activity from July to August and from August to September in the neighborhood of the Western Ghats were studied in detail on the basis of a close network of raingage stations, and the role of the Western Ghats was examined. The criterion used for defining the major climatological discontinuity was based on the quartiles of the monthly rainfall distribution. The Western Ghats appear to play a differential role. Since meteorological conditions are most favorable during July and become progressively less favorable with the advance of the summer monsoon season, the Western Ghats enhance rainfall substantially under favorable conditions, and decrease the rainfall substantially under relatively unfavorable conditions, and thus contribute to the major climatological discontinuities. (Sims-ISWS)
W79-06754

THE DEVELOPMENT OF ORGANIC ICE NUCLEI GENERATORS FOR WEATHER MODIFICATION,
Denver Research Inst., CO. Cloud Physics Lab.
N. Fukuta, M. N. Plooster, J. A. Armstrong, A. Gorove, and J. R. Butz.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-274 952, Price codes: A07 in paper copy, A01 in microfiche. Final Report, Volume I, NSF/RA-770136, June 1977. 140 p, 37 fig, 5 tab, 68 ref, 4 append. NSF ENV73-02910.

Descriptors: *Weather modification, *South Dakota, *Cloud seeding, *Equipment, Rainfall, Cloud physics, Nucleation, Aircraft, Weather, Meteorology, Climatology, Organic ice nuclei, Generators.

The development of prototypes of ground and airborne organic smoke generators was addressed. The center of the program reported involved the development of three kinds of organic ice nuclei generators. Two supporting studies, one on the performance of supersonic nozzles to optimize the nozzle design, and the other on ice nucleation mechanisms of organic smoke particles using a new thermal diffusion chamber, were also discussed. Also, a prototype generator tested in cumulus clouds in South Dakota showed encouraging effects of seeding. (Sims-ISWS)
W79-06765

THE EFFECTS OF THE 1975-76 DROUGHT ON GROUNDWATER AND AQUIFERS,
Institute of Geological Sciences, London (England). Dept. of Hydrogeology.
For primary bibliographic entry see Field 2E.
W79-06807

PREHISTORIC PALAEOECOLOGY OF THE SAHARA ATLANTIC COAST IN THE LAST 10,000 YEARS: A SYNTHESIS,
Centre Univ. de Luminy, Marseille (France). Lab. de Geologie du Quaternaire.
N. Petit-Maire.
Journal of Arid Environments, Vol 2, No 1, p 85-88, March 1979. 1 fig, 9 ref.

Descriptors: *Paleoclimatology, *Archaeology, Recent Epoch, Dating, Droughts, Quaternary period, Climatic data, Arid climates, Invertebrates, Mammals, History, Sahara, Morocco, Mauritania, Coasts, Deserts, Littoral.

Results of recent interdisciplinary studies of the remains of Quaternary prehistoric sites and Holocene human occupation along the present Atlantic coast between Morocco and Mauritania point to a decrease in aridity around 3500 BP. This synthesis of the invertebrate fauna, large mammalian fauna, palaeobotany, archaeological context, and human remains suggests a slight decrease in aridity between 3000 and 4000 BP, with sedentary life in the Sahel extension zone up to 20-21N, and semi-sedentary occupation further north. Differences in the continuity and density of sites are correlated mainly with the littoral profiles and/or with the proximity to water-holes or wells. It is speculated that prehistoric inhabitants switched from a hunting-gathering economy during faunal optimas to a predominantly seafood gathering activity during the most unfavorable arid periods. (Tickes-Arizona)
W79-06836

2C. Snow, Ice, and Frost

SATELLITES AS AN AID TO WATER RESOURCE MANAGERS,
National Environmental Satellite Service, Washington, DC.
D. F. McGinnis, Jr., R. A. Scofield, S. R. Schneider, and C. P. Berg.
Presented at American Society of Civil Engineers, Convention and Exposition, held in Boston, MA, on April 2-6, 1979. 23 p, 11 fig, 1 tab, 18 ref.

Descriptors: *Satellites(Artificial), *Water resources, *Remote sensing, Flood, Precipitation, Hurricanes, Snow, Ice breakup, Rivers.

The National Oceanic and Atmospheric Administration (NOAA) currently operates two different satellite systems, the NOAA polar-orbiting satellites and the GOES system of geostationary satellites. The two GOES satellites currently operational are stationed over the equator at 75W and 135W longitude, respectively. Examples of satellite data applications to water resource problems are presented to draw attention to a current source of data often overlooked by water managers. Although spatial and temporal constraints exist, satellite data can contribute useful information toward solutions of mesoscale and macroscale water resource problems; e.g., areal snow cover determinations, river ice, flood extent, and short-term precipitation estimates. Satellites are a valuable source of remotely sensed data whose potential as a water resource management tool needs to be more extensively appreciated by the engineering community and more extensively developed by the hydrologic community. (NOAA)
W79-06505

ON HEAT AND MASS FLUX THROUGH DRY SNOW,
Oslo Univ. (Norway). Dept. of Mechanics.
E. Palm, and M. Tveitereid.
Journal of Geophysical Research, Vol 84, No C2, p 745-749, February 20, 1979. 6 fig, 1 tab, 11 ref.

Descriptors: *Snow, *Heat flow, *Convection, *Mathematical models, Model studies, Analytical techniques, Analysis, Theoretical analysis, Water vapor, Thermal properties, Mass transfer, Porous media, Boundary processes, Thermal convection.

The conditions for obtaining thermal convection in dry snow were examined. It was shown that thermal convection will occur in dry snow layers with strong vertical temperature gradients and large air permeabilities (i.e., old snow). Thermal convection will lower the insulating power of the snow and increase the flux of water vapor through the snow layer. It will also lead to a pronounced decrease in snow density in the lower part of the snow layer and an increase in snow density in the upper part of the snow layer. Thermal convection may be important for the rate of formation of depth hoar. The magnitude of the heat and mass flux in convection was computed for several values of the Rayleigh number. (Humphreys-ISWS)
W79-06585

SPECTRAL DISTRIBUTION OF RADIATION IN THE NORTHERN GREAT LAKES DURING WINTER,

National Oceanic and Atmospheric Administration, Ann Arbor, MI. Great Lakes Environmental Research Lab.
For primary bibliographic entry see Field 2H.
W79-06596

MODELLING ICE DISSIPATION IN EASTERN LAKE ERIE,
State Univ. of New York at Buffalo. Dept. of Civil Engineering.
R. R. Rumer, Jr., and P. M. Yu.
Journal of Great Lakes Research, Vol 4, No 2, p 194-200, June 1978. 3 fig, 1 tab, 15 ref. NOAA 2-35281, 03-6-022-35236.

Descriptors: *Lake Erie, *Great Lakes, *Ice cover, *Lake ice, *Model studies, Mathematical models, Heat transfer, Iced lakes, Ice loads, Meteorological data, Climatic data, Analytical techniques, Ice, *Niagara River, Ice dissipation, Ice thickness.

A previously developed mathematical model, which considered both the heat exchange processes at the air-ice interface and the ice transport rate via the Niagara River, was used to simulate the ice dissipation process in eastern Lake Erie. The model, which assumed the ice thickness to be constant over the lake, has been further developed to take into account variable ice thickness. Buffalo meteorological data were used for the computation of the net heat exchange at the air-ice interface. Results of the model application illustrated the relative importance of in-lake ice melt to ice transport via the Niagara River during the dissipation period. Model results were found to give reasonably good agreement with the limited ice information available for the 1976 dissipation period. (Sims-ISWS)
W79-06598

TEMPERATURE FINE STRUCTURE NEAR THE SEA-ICE MARGIN OF THE CHUKCHI SEA,
Naval Postgraduate School, Monterey, CA. Dept. of Oceanography.
For primary bibliographic entry see Field 2L.
W79-06739

AN EXPERIMENTAL STUDY OF BRINE DRAINAGE AND CONVECTION IN YOUNG SEA ICE,
Washington Univ., Seattle. Dept. of Oceanography.
T. M. Niedrauer, and S. Martin.
Journal of Geophysical Research, Vol. 84, No. C3, p 1176-1186, March 20, 1979. 17 fig, 1 tab, 14 ref. ONR NR 307-252, N00014-76-0234.

Descriptors: *Sea ice, *Brines, *Laboratory tests, Ice, Sea water, Ice-brine systems, Ice-water interfaces, Desalination, Equipment, Photography, Convection, Temperature, Channels, Oceanography.

In a series of experiments using a 1.6-mm-thick freezing tank, thin sections of salt water ice were grown which exhibit the same drainage features as natural sea ice. The tank design permitted photographs to be taken, while thermocouples mounted in the tank walls recorded the temperature profiles within the ice. Convection was observed in both the skeletal layer and in the brine channels by the flow of dyed brine. Flow in the skeletal layer was cusplike in appearance, consisting of narrow downflow regions separated by broad upflow regions. Above the skeletal layer, several brine channels were also usually present in the ice, and convective overturning occurred in these channels. The convection caused temperature fluctuations of 0.05 deg C, which calculations show increase the vertical heat flux by 1%. The brine drainage channels, which were usually sloped 30 deg to 60 deg to the horizontal, always had isotherms tilted from 0 deg to 13 deg in the same direction. The brine channels move both horizontally and vertically through the ice by melting their lower walls and freezing on the upper walls. An analysis based on the heat flux due to brine channel convection showed that convection can drive these wall movements. Observations suggested that most of the brine movement in the channels is caused by recirculation of water from below the ice. On a small scale, the formation of brine pockets from brine tubes also was observed. (Sims-ISWS)
W79-06757

ICE GROWTH STUDIES IN DULUTH-SUPERIOR HARBOR 1974-75,
Minnesota Univ. -Duluth.
R. T. Clapper Jr., D. Smith, K. Stortz, and M. Sydor.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-272 170, Price codes: A04 in paper copy, A01 in microfiche. Report, September 5, 1975. 68 p, 39 fig, 3 tab, 8 ref, 2 append. NOAA 04-5-022-13..

Descriptors: *Lake ice, *Great Lakes, *Harbors, *Lake Superior, Ice, Ice loads, Ice cover, Heat budget, Physical properties, Model studies, Mathematical models, On-site investigations, Water temperature, Radiation, Solar radiation, Lakes, Navigation, *Duluth-Superior Harbors.

This study concerned the investigation of the ice growth and heat budget in the Duluth-Superior Harbor. The Harbor, located at the extreme western end of Lake Superior, is one of the major shipping ports on the Great Lakes. It is ice bound from mid December to mid April, causing cessation of interlake shipping in the winter months. Interest in the extension of winter shipping has gained lately in light of recent economical considerations for transportation of coal and oil along the Great Lakes. Initial investigations on the feasibility of winter shipping in Duluth resulted in installation of an experimental bubbler system which was devised to keep the channels open in the early winter to facilitate shipping of iron ore and movement of vessels into the Harbor for repair and modification. The limited bubbler installation in Howards Bay, 1973-74, for instance, proved to be quite successful in retarding ice growth. However, the physical principles governing the ice growth in the Harbor are complex and are not well understood. Thus, problems arising in ice growth forecasting, design, and construction of ice retarding methods, and evaluation of the environmental implications of winter shipping require a detailed investigation on the physical processes and the heat budget for the entire Harbor. (Sims-ISWS)
W79-06763

SNOW SURVEY AND VEGETATION GROWTH IN THE SWISS ALPS,
Zurich Univ. (Switzerland). Dept. of Geography.
For primary bibliographic entry see Field 7B.
W79-06764

2D. Evaporation and Transpiration

EQUATIONS OF VOLUME AND SALT BALANCES OF BRINE PONDS,
Moscow Highway Inst. (USSR).
For primary bibliographic entry see Field 2A.
W79-06611

TERRITORIAL DISTRIBUTION OF THE RELATIONSHIPS BETWEEN COMPONENTS OF WATER AND HEAT BALANCES,
Akademiya Nauk SSSR, Moscow. Inst. Vodnykh Problem.
For primary bibliographic entry see Field 2A.
W79-06616

EVAPOTRANSPIRATION BED DESIGN,
Goodson (Raymond L.) Inc., Dallas, TX.
A. F. Beck.
Journal of the Environmental Engineering Division, American Society of Civil Engineers, Vol. 105, No. EE2, Technical Note, p 411-415, April 1979. 1 fig, 2 tab, 1 ref, 1 append.

Descriptors: *Evapotranspiration, *Soil disposal fields, *Beds, *Design, Water pollution, Underwater, Drains, Drainage, Septic tanks, Soils, Temperature, Rainfall, Lodging, Urbanization, Water uses, *Septic tank effluent, Experimental ET beds, Pan evaporation, Bare soil, St. Augustine grass.

Evapotranspiration beds are used in lieu of drain fields in disposing of septic tank effluent in areas where the soil can't absorb water or where water is absorbed so rapidly that there is a possibility of contamination of underground water. Twice daily field measurements of water depth in 12 experimental ET beds were made from April 1976-March 1977 in San Antonio, Texas. In addition, measurements were also made of temperature, rainfall, and pan evaporation. It was concluded that evapotranspiration beds ranging from 777 square feet to 1,295 square feet can serve two- to four-bedroom houses. The beds should be shallow to reduce construction costs and to take advantage of high evapotranspiration rates near the ground surface. Beds should be level, and the top of the bed should be mounded to keep rainwater from ponding over the bed. A thick grass growth on the surface of the bed is desirable but not necessary. Evapotranspiration beds function on rainy days, but they can not be used where the bed surface freezes. (Roberts-ISWS)
W79-06748

NATURAL FREEZE-THAW SEWAGE SLUDGE CONDITIONING AND DEWATERING,
Rush Engineering Services Limited, Listowel, Ontario.
R. J. Rush, and A. R. Stickney.
Environmental Protection Service, Ottawa, Canada. Technology Development Report EPS 4-WP-79-1, January 1979, 40 p, 4 fig, 12 tab, 24 ref.

Descriptors: *Freeze-thaw tests, *Sewage sludge, *Dewatering, Watersheds(Basins), Sewage lagoons, Activated sludge, Aerobic treatment, Anaerobic digestion, Biochemical oxygen demand, Chemical oxygen demand.

In 1975, an experimental program was initiated at the Wastewater Technology Centre (WTC), Burlington, with the overall objective of developing an engineering design method for natural freeze-thaw sewage sludge dewatering on drainage beds. This study reports on a laboratory investigation and preliminary design for a natural freeze-thaw sewage sludge process. Four types of sewage sludge (conventional waste activated, extended aeration waste activated, aerobically digested and anaerobically digested) were frozen, thawed and drained on bench scale drainage beds. The effect of various sludge addition rates on sludge dewatering characteristics and filtrate quality was evaluated and sludge freezing rate information collected. All of the sewage sludges investigated showed a marked improvement in dewaterability after freeze-thaw. The rate of sludge application had no discernible effect on the results over the range studied. (WATDOC)
W79-06854

2E. Streamflow and Runoff

FLOOD HAZARD INFORMATION: ANIMAS RIVER AND JUNCTION AND DRY GULCH CREEKS, DURANGO, COLORADO.
Army Engineer District, Sacramento, CA.
Prepared for The City of Durango and The Animas Regional Planning Commission, CO, May, 1977. 11 p, 10 fig, 20 plates, 4 tab.

Descriptors: *Cloudbursts, *Historic floods, *Flood data, *Animas River(CO), *Colorado, *Junction Creek(CO), *Dry Gulch Creek(CO), Floods, Flooding, Flood flow, Indirect flood measurement, Flood profiles, Storms, Flood recurrence interval, Flood stages, Peak discharge, Stage-discharge relations, Rivers, Floodways, Flood plains, Channels, Durango(CO), 100-year flood, 500-year flood.

This report details flood hazard information for a 9 mile study reach of the Animas River, as well as for Junction Creek (4 mi) and Dry Gulch Creek (1 mi) in the vicinity of the Town of Durango in Southwestern Colorado. Drainage areas for the three streams' study reaches are: Animas River-765 square miles, Junction Creek-39 square miles, and Dry Gulch Creek-4 square miles. Floodplain width ranges from about 1/8 mile for Junction and Dry Gulch Creeks to 1/2 mile for the Animas River. Commercial, residential, and agricultural development exists in the floodplain, and some future development is predicted. Streamflow data for the Animas River are from a U.S. Geological Survey gage near the U.S. Highway 550. No gage information is given for Dry Gulch and Junction Creeks. Flooding is caused by runoff from spring snowmelt, localized cloudburst storms and rainstorms. Obstructions to flood flow include trees, brush, streambank vegetation, and three major highway bridges. The greatest flood in history occurred in June, 1927, with a peak discharge of 20,000 cubic feet per second (cfs) on the Animas River. The most recent heavy flooding occurred in October, 1972 on Junction Creek. The 100-year flood would have a peak discharge of 24,000 cfs on the Animas River and the 500-year flood would discharge 40,500 cfs. Average 100-year flood velocity of flow for the three streams could reach as high as 13 feet per second (fps) for the main channel and 4 fps for the overbank areas. (Arnold-NC)
W79-06532

FLOOD HAZARD INFORMATION: COLORADO RIVER, PALISADE, COLORADO.
Army Engineer District, Sacramento, CA.
Prepared for The Town of Palisade and Mesa County, CO., November 1976. 5 p, 31 plates, 1 tab.

Descriptors: *Floods, Flood profiles, *Flood plains, *Colorado River(CO), *Colorado, *Palisade(CO), Flooding, Flood flow, Indirect flood measurement, Storms, Cloudbursts, Historic floods, Flood data, Flood frequency, Flood damage, Erosion, Rivers, Floodways, Channels, Flood protection, Flood plain zoning, Mesa County(CO), 500-year flood, 100-year flood.

This report details flood hazard information for that portion of the Colorado River in the vicinity of the Town of Palisade in Mesa County east of the City of Grand Junction in extreme Western Colorado. The length of the study reach is about 10 miles from Interstate Highway 70 downstream to State Road 32. Drainage area is about 8,800 square miles above Palisade. Flood plain width varies from about 1,500-3,000 feet. Some residential and commercial development exists in the flood plain, although primary use is agricultural. Development is projected to be very slow, with a 10% increase projected by the year 2000. Causes of flooding are heavy spring, summer and fall rainstorms, and runoff from spring snowmelt. The most recent major flood occurred in 1957, although the 1884 flood is considered the area's most serious event. Major obstructions to flow include trees, brush and vegetation along the streambank, as well as highway bridges. Flood profiles are presented for the 100- and 500-year floods. The 100-year flood could cause the Colorado River to be out of its banks for almost the entire study area but would remain mostly within its natural flood plain; the 500-year flood would follow much the same pattern but would be deeper. Channel velocities of the 100-year flood would cause severe bank erosion. No structured control measures exist in the study reach; Mesa County has adopted flood plain regulations and Palisade has zoning ordinances but they do not address flood hazards. (Arnold-NC)
W79-06533

TWO-DIMENSIONAL SHALLOW WATER-WAVE MODELS,
Louisville Univ., KY. Dept. of Civil Engineering.
For primary bibliographic entry see Field 8B.
W79-06588

TRANSPORT OF REACTING ADMIXTURES IN A TURBULENT FLOW,
Akademiya Nauk SSSR, Moscow. Inst. Vodnykh Problem.
For primary bibliographic entry see Field 5B.
W79-06613

INPUT-OUTPUT MODEL FOR RUNOFF-SEDIMENT YIELD PROCESSES,
Govind Ballabh Pant Univ. of Agriculture and Technology, Pantnagar (India). Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 2J.
W79-06617

ESTIMATING SEDIMENT TRANSPORT IN A BRAIDED GRAVEL CHANNEL--THE KAWERONG RIVER, BOUGAINVILLE, PAPUA NEW GUINEA,
Papua and New Guinea Univ., Port Moresby (New Guinea).
For primary bibliographic entry see Field 2J.
W79-06618

SYNTHESIS OF FLOW-DURATION CURVES FOR UNREGULATED STREAMS IN NEW HAMPSHIRE,
New Hampshire Univ., Durham. Inst. of Natural and Environmental Resources.
S. L. Dingman.
Water Resources Bulletin, Vol. 14, No. 6, p 1481-1502, December 1978. 6 fig, 5 tab, 19 ref. OWRT A-040-NH (1), 14-31-0001-4029.

Descriptors: *Streamflow, *Variability, *Flow duration, New Hampshire, Curves, Streams, Watersheds(Basins), Data processing, Analytical techniques.

Flow-duration curves are concise pictures of flow variability at a point on a stream, and they provide essential information for all water resource planning. In New Hampshire, useful estimates of flow-duration curves for ungaged points on unregulated streams can be made using only information readily available from contour maps: (1) area of the basin above the point of interest; and (2) either the measured mean basin elevation or the elevations of the highest and lowest points in the basin. Measured or estimated mean basin elevation then is used in regression equations to estimate mean flow Q(mean) and the flow exceeded 95% of the time, Q sub 95. Q(mean) was assumed to occur at the 27% exceedance frequency. Q sub 02, Q sub 05, and Q sub 30 were estimated as multiples of Q(mean). Equations were provided for calculating 95% confidence intervals for future estimates using the method. The dependence of mean flow on elevation is due to positive vertical precipitation gradients and negative vertical evapotranspiration gradients. The dependence of Q sub 95 on elevation appears to be due largely to the fact that it rains more often, that snowmelt takes longer, and that evapotranspiration is reduced at higher elevations. (Sims-ISWS)
W79-06725

A PLANNING ALGORITHM TO ASSESS THE IMPACT OF URBAN GROWTH ON FLOOD EXPECTANCY,
Colorado State Univ., Fort Collins. Coll. of Forestry and Natural Resources.
M. E. Smith, and D. O. Doehring.
Hydrological Sciences Bulletin, Vol 23, No 2, p 245-255, June 1978. 6 fig, 2 tab, 12 ref. OWRT B-147-COLO(2).

Descriptors: *Urbanization, *Flood frequency, Methodology, Analytical techniques, New England, Urban runoff, Algorithms, Regression analysis, Drainage area, Land use, Mathematical studies, *Flood expectancy, Urban growth impact, Morphometric parameters.

Standard engineering and planning practice regarding flood hazard delineation in the U.S. are based on the assumption that a 100-year flood is static and that it is not affected significantly by subsequent urbanization of the basin. Research reported in the paper demonstrated that this assumption is unjustified when hydrological response of a basin to extensive urban growth depends on geological and morphometric parameters. The causal relationships were synthesized into an algorithm which predicts the change in discharge in 50- and 100-year floods on the basis of indices of urban land use changes, surficial properties of the catchment, and the configuration of the drainage network. The algorithm was developed by a stepwise multiple regression technique, and it utilized data from 18 basins in southeastern New England. (Singh-ISWS)
W79-06726

EXTERNALITIES FROM URBAN GROWTH: THE CASE OF INCREASED STORM RUNOFF AND FLOODING,
Iowa Univ., Iowa City. Inst. for Economic Research.
J. R. Bernard.
Land Economics, Vol. 54, No. 3, p 298-315, August 1978. 3 fig, 1 tab, 27 ref. OWRT A-053-IA and B-055-IA (4) (1).

Descriptors: *Urbanization, *Flooding, *Urban-runoff, Iowa, Storm runoff, Flood damage, Property values, Watersheds(Basins), Model studies, Mathematical models, Econometrics, Flood plains, Social costs, Cost-benefit analysis.

Expansion of Iowa City, Iowa, has increased the runoff and flood hazard in nearby Ralston Creek watershed, and the flood hazard has negatively affected property values in the lower portion of the watershed. Hydrological and economic evidence thus shows that urban growth produces a negative externality in the form of increased flood hazard to downstream properties, primarily because of increases in the area of impervious surfaces, as well as a negative income distribution effect. Since estimated social costs from hazards of urbanization are relatively small compared with large and costly flood control or diversion schemes, such projects would involve unfavorable benefit-cost ratios. Upstream urban development should be controlled to avoid further increases in runoff, and older properties subject to flooding should be converted to uses compatible with the level of flood hazard, such as parks or parking lots. Detailed cost-benefit analysis would be needed to assess options. New design and planning methods for storm runoff control show promise of cost savings over conventional methods, while at the same time solving urban runoff problems. Two severe floods have occurred in the watershed in recent years, the latest in 1972. The influence of flood hazard was measured by an econometric model of property values. (Lynch-Wisconsin)
W79-06727

EFFECTS OF DRAINAGE PROJECTS ON SURFACE RUNOFF FROM SMALL DEPRESSIONAL WATERSHEDS IN THE NORTH CENTRAL REGION,
Minnesota Univ., St. Paul. Dept. of Agricultural Engineering.
I. D. Moore, and C. L. Larson.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-295 796, Price codes: A11 in paper copy, A01 in microfiche. Water Resources Research Center, University of Minnesota, Bulletin 99. January 1979. 225 p, 40 fig, 9 tab, 110 ref, 7 append. OWRT B-122-MINN (1), 14-31-0001-6092.

Descriptors: *Surface runoff, *Wetlands, *Drainage, *Flood flows, Low flows, Watershed model, *Small watersheds.

Surface runoff from small watersheds characterized by numerous depressions was studied statistically and by use of a special purpose watershed model. The statistical analyses illustrated the possible magnitude of the storage effect exhibited by lakes, marshes and other depressions. Because of data limitations statistical techniques could not be used to examine the effects on flood runoff of draining these same areas. The model represents

the processes of snowmelt, infiltration, soil moisture storage, evapotranspiration, subsurface and surface runoff for four different land drainage conditions, with or without channel development. Application of the model to two small watersheds in Jackson County, Minnesota indicated that drainage development increases annual runoff, storm runoff and peak discharge. The physical characteristics of the main water course in the watershed was the major factor influencing peak discharge at the watershed outlet. Examination of annual flood flows on the Minnesota River at Mankato suggests that downstream effects of drainage development on large watersheds are much less than indicated by this study on small watersheds. Downstream effects and flooding within a watershed are discussed in general terms.
W79-06729

THE MEASUREMENT OF INTERACTIVE FRESHWATER AND TIDAL FLOWS IN THE RIVER DEE, NORTH WALES,
Welsh National Water Development Authority, Cardiff. Dee and Clwyd Sewage Div.
For primary bibliographic entry see Field 2L.
W79-06747

ON THE NUMERICAL COMPUTATION OF TWO-LAYER NEARLY HORIZONTAL FLOWS,
Seaconsult Marine Research Ltd., Vancouver (British Columbia).
D. O. Hodgins.
Journal of Hydraulic Research, Vol. 17, No. 1, p 23-41, 1979. 8 fig, 1 tab, 12 ref.

Descriptors: *Stratified flow, *Model studies, *Analytical techniques, Mathematical models, Analysis, Mathematical studies, Stability, Subcritical flow, Flow, Laboratory tests, Hydraulic models, Waves(Water), Water levels, Numerical analysis, Methodology, Estuaries, Lakes, Two-layer flow, Finite difference method.

An implicit finite difference method was described for solving the equations of motion of a two-layer stably stratified fluid in one dimension. The computational scheme is applicable to smoothly varying subcritical flows and is formulated in terms of layer transport and thickness in order to optimize computer efficiency. Stability analyses of the method show that waves forming at the grid scale are undamped and two approaches for controlling this wave growth were discussed. Comparisons with experimental data show the method to be accurate provided that the natural long wave motions are well resolved and the grid scale waves are filtered from the solutions. Numerical tests indicate a minimum of 20 points per wave length or period can be considered as a lower limit for resolution. (Humphreys-ISWS)
W79-06758

NEW INTERPRETATION OF SOME HEAD LOSS-FLOW VELOCITY RELATIONSHIPS FOR DEFORMABLE MOVABLE BEDS,
Grenoble-1 Univ. (France). Inst. de Mecanique.
J. P. Chollet, and J. A. Cunge.
Journal of Hydraulic Research, Vol. 17, No. 1, p 1-13, 1979. 9 fig, 8 ref, 3 append.

Descriptors: *Head loss, *River beds, *River flow, Velocity, Friction, Hydraulics, Sediment transport, Movement, Roughness(Hydraulic), Rivers, Dunes, Sands, *Movable beds, Deformable beds, Einstein method, Engelund method.

The roughness of movable beds, which are deformed by the formation of sand dunes, is not constant since bed topography is dependent on flow characteristics. The relationship between the energy dissipated by the flow and its average velocity deviates, therefore, from the quadratic form generally used to express hydraulically rough flow; nevertheless, it is possible to describe the general form of this relationship and then to determine its exact terms using the Einstein and Engelund methods. (Lee-ISWS)
W79-06760

EVALUATION OF HYDROLOGIC MODELING TECHNIQUES FOR FOREST LAND MANAGEMENT PLANNING,
Washington State Dept. of Natural Resources, Olympia.
J. A. Ryan.
Water Resources Bulletin, Vol. 15, No. 2, p 461-472, April 1979. 5 fig, 2 tab, 16 ref.

Descriptors: *Hydrology, *Simulation analysis, *Forest management, *Evaluation, *Mathematical models, Planning, Timber harvesting, Environmental effects, Ecosystems, Discharge(Water), Equations, Streams, Water temperature, Multicycle system, Systems analysis, Water quality.

A growing concern for environmental quality paralleled with increasing demands on our forest resources has prompted the Washington State Department of Natural Resources to evaluate simulation modeling as a technique for analyzing management decisions in terms of their environmental effects. The evaluation focused on a system of integrated models developed at the University of Washington which simulate processes and activities within the forest ecosystem. A major part of the system is a hydrologic model which predicts changes in discharge, stream temperature, and concentrations of suspended sediment and dissolved oxygen based on information generated by other models representing intensive management practices. The evaluation consisted of applying the system to a 72,000 acre watershed and determining the pertinence of hydrologic modeling for management purposes. Results show several potential uses of hydrologic modeling for forest management planning, especially for analyzing the effects of timber harvesting strategies on water quality. (Bell Graf-Cornell)
W79-06801

THE EFFECTS OF THE 1975-76 DROUGHT ON GROUNDWATER AND AQUIFERS,
Institute of Geological Sciences, London (England). Dept. of Hydrogeology.
J. B. W. Day, and J. C. Rodda.
Proceedings of the Royal Society of London, Series A, Vol. 363, No. 1712, p 55-68, 1978. 10 fig, 11 ref.

Descriptors: *Droughts, *Europe, *Water level fluctuations, *Water storage, Water shortage, Water levels, Precipitation, Aquifers, Hydrographs, Water wells, Withdrawal, Surface-groundwater water relationships, Base flow, Ground water recharge, Conjunctive use, England.

Approximately one-third of the water used for public supply in England and Wales is ground water. During the 1975-76 drought, water levels and storage in the major aquifers, the Chalk and the Triarsic sandstones, generally declined. In unconfined aquifers levels were a few meters below normal, but in confined aquifers with less storativity, levels dropped more than 10 meters. By August, 1976, record low levels were being registered in many wells due possibly to the effect of pumping. Water levels in some aquifers, particularly the Chalk, did not respond immediately to precipitation at the end of the summer. By the spring of 1977, ground water levels were at or above those of the previous four years, except in areas with previous overdraft. No permanent or long-term adverse physical or chemical effects on the aquifers have been noted thus far. Exploitation of ground water in deep storage during a drought would be difficult due to high cost, limited drilling facilities, deterioration of quality, decreases in stream baseflow, and possible reduction in well yield due to decreased permeability. Conjunctive use of surface and ground water and use of poor-quality water from shallow aquifers for non-potable purposes are more promising drought prevention measures. (Purdin-NWWA)
W79-06807

RUNOFF RAINFALL ANALYSIS FOR BARE SOILS,
Israel Soil Conservation and Drainage Div., Emek Hefer; and Weizmann Inst. of Science, Rehovoth (Israel). Computer Center.
J. Morin, and H. S. Jarosch.
Israel, Soil Erosion Research Station, Emek Hefer, Pamphlet No. 164, 1977, 22 p, 2 fig, 4 tab, 15 ref.

Descriptors: *Rainfall-runoff relationships, *Surface runoff, *Watershed managements, *Depth-area-duration analysis, *Surface-groundwater relationships, Storm runoff, Discharge(Water), Rainfall intensity, Runoff coefficient, Runoff forecasting, Time series analysis, Infiltration, Soil erosion, Vegetation effects, Soil conservation, Forecasting, Simulated rainfall, Design criteria, Infiltration rates.

A detailed quantitative analysis of rainfall-runoff relationships on small watersheds is of vital importance in soil conservation programs. A method is described here for predicting the quantity and discharge of runoff from cultivated areas which makes possible the analysis of real long-term rainfall data for a certain zone in order to obtain the synthetic runoff values on the basis of probability. Rainfall intensity data collected by the Israel Hydrological Service was computer-analyzed on the basis of relationships obtained from field experiments with rain simulation on characteristic soils and methods of cultivation. The prediction of runoff by the method described here is divided into and analyzed in three stages: (1) analysis of rain, (2) runoff under uniform infiltration conditions, and (3) runoff with varying infiltration rates of the soil. Results of analysis have shown that crust formation and wetting, and that for most soil types in the Mediterranean and other semiarid zones, runoff consists of surface flow with almost no components of underground horizontal flows. It is the opinion of these authors that the method of predicting discharge and runoff volume utilizing the combination of infiltration curves obtained by artificial rain systems together with the analysis of actual rain data, which they describe, is a promising approach for quickly obtaining design parameters which are based upon long-term probability. (Tickes-Arizona)
W79-06837

STREAM NETWORK ANALYSIS AND GEOMORPHIC FLOOD PLAIN MAPPING FROM ORBITAL AND SUBORBITAL REMOTE SENSING IMAGERY APPLICATION TO FLOOD HAZARD STUDIES IN CENTRAL TEXAS,
Texas Univ. at Austin. Dept. of Geological Sciences.
For primary bibliographic entry see Field 7B.
W79-06877

URBAN STORM WATER MANAGEMENT: DISTRIBUTION OF FLOOD VOLUMES,
Massachusetts Inst. of Tech., Cambridge. Dept. of Civil Engineering.
S-O. Chan, and R. L. Bras.
Water Resources Research, Vol. 15, No. 2, p 371-382, April 1979. 19 fig, 3 tab, 14 ref.

Descriptors: *Urban hydrology, *Storm water, *Flood volumes, *Frequency distribution, *Rainfall, Management, Overflow, Sewers, Hydrologic data, Hydrographs, Simulation analysis, Runoff, Equations, Intensity, Duration, Systems analysis, Joint probability density function, Closed analytical form, Annual exceedance series, Kinematic wave functions, Design.

The frequency distribution of the volume of water above a given threshold discharge is developed. This is done using basic and accessible information like the joint probability density function of rainfall intensity and duration together with expressions, to be derived, relating the volume of interest to rainfall intensity and duration. The resulting distribution function is in a closed analytical form containing only a few climatological and physical parameters of a catchment. This distribution function will be of great value in the design of storage devices, flood control systems, and storm water treatment facilities in urban areas. (Bell Graf-Cornell)
W79-06934

A COMPARISON OF THREE FLOODING REGIMES, ATCHAFALAYA BASIN, LOUISIANA,
Coastal Environments, Inc., Baton Rouge, LA.
For primary bibliographic entry see Field 4A.
W79-06943

2F. Groundwater

PROGRAMMING A POCKET CALCULATOR FOR SOLVING MULTIPLE WELL, VARIABLE PUMPING RATE PROBLEMS,
Stone and Webster Engineering Corp., Boston, MA.
For primary bibliographic entry see Field 7C.
W79-06593

CHANGING PATTERNS OF GROUND-WATER USE IN THE UNITED STATES,
NSF Science for Citizens Program, Madison, WI.
For primary bibliographic entry see Field 7C.
W79-06594

GROUND-WATER COMPUTER MODELS–STATE OF THE ART,
Camp, Dresser and McKee, Inc., Champaign, IL. Water Resources Div.
T. A. Prickett.
Ground Water, Vol 17, No 2, p 167-173, March-April 1979. 80 ref.

Descriptors: *Computer models, *Groundwater, *Model studies, *Technology, Methodology, Research and development, Analytical techniques, Numerical analysis, Finite element analysis, Analog models, Finite difference models.

The 3 main characteristics that put the use of groundwater models into the class of intellectual toys are as follows. First, the wrong model is frequently chosen for problem-solving, of which overkill by use of an overly sophisticated model is an example. Secondly, the paying agency or client is often disillusioned with the model results because of frequent modeler oversell in the early stages of project planning and budgeting. Thirdly, the problems are often solved with a numerical code that is a mystery to all except the modeler himself. The 3 main characteristics that make groundwater models very practical tools are as follows. First, there is no doubt that the models of today can solve extremely complex groundwater flow problems. Second, the models of today are available to virtually everyone in the groundwater business. And third, having a computer code and data deck available is a perfect tool for transferring information to another person as to how a problem was solved. This paper also included a very brief description of the state-of-the-art of groundwater modeling and a very comprehensive reference list of useable models. (Visocky-ISWS)
W79-06595

NONSTEADY FLOW TO NONPENETRATING WELL,
Iowa State Univ., Ames. Dept. of Agricultural Engineering.
R. S. Kanwar, H. P. Johnson, and H. S. Chauhan.
Journal of the Irrigation and Drainage Division, American Society of Civil Engineers, Vol. 105, No. IR1, Proceedings Paper 14458, p 45-55, March 1979. 4 fig, 2 tab, 16 ref, 2 append.

Descriptors: *Aquifer characteristics, *Wells, *Unsteady flow, Aquifers, Drawdown, Hydraulic conductivity, Penetration, Hydraulics, Pump testing, Transmissivity, Flow, Steady flow, *Nonequilibrium flow, Well hydraulics.

A nonequilibrium formula was obtained to predict the nonsteady drawdown distribution near a cavity well discharging from a nonleaky artesian aquifer. A graphical method was suggested to find such aquifer properties as specific storage coefficient and hydraulic conductivity. The practical utility of this method was demonstrated by utilizing the pumping test data for a particular aquifer. The results of the pumping tests were given, and the values of hydraulic conductivity and specific storage were compared with the well-known method of Theis. If the values of aquifer properties are found to be satisfactory from this solution, the use of other methods that require the drilling of fully penetrating wells could be avoided easily, which will make the cost of investigation of aquifer properties reasonably small. (Lee-ISWS)
W79-06607

OBSERVATIONS OF THE SUBSURFACE WATER REGIME IN THE TERRITORY OF CZECHOSLOVAKIA,
H. Kriz, and I. Krizova.
Water Resources, Vol. 4, No. 6, p 952-956, November-December 1977. 1 fig, 1 tab, 4 ref. Translated from Vodnye Resusry, No. 6, p 187-192, November-December 1977.

Descriptors: *Subsurface waters, *Groundwater, *Wells, *Springs, Observation wells, Water wells, Water levels, Water supply, Water resources, On-site investigations, Precipitation(Atmospheric), Hydrologic data, Hydrology, Hydrogeology, *Czechoslovakia.

A study of the subsurface water regime in the territory of modern Czechoslovakia began later than hydrologic observations, mainly observations of the level of rivers. Single measurements of the discharge of certain large springs were made as long ago as 1881-1890, but systematic observations of the subsurface water regime for water supply and other water management purposes began only at the turn of the century. The fact is that purposeful observations were primarily irregular and brief. The sole exceptions are the long-term observations of the level of subsurface waters and discharge of springs which have been carried out since the turn of the century in the southern part of the Ceska Trebova Highlands. These observations in the territory of Czechoslovakia do not have an analogy, and from the viewpoint of duration are unique on a worldwide scale. Observations in 10 wells began as long ago as at the end of 1899 and in the ensuing years gradually encompassed other installations. Measurements of the discharge of the first two springs (Sulka spring in Brezov near the Svitava River and Nadrazin spring in the village of Brnenc) began in 1900. The results of these unique observations are of great value, because they permit judging the changes in the supply of subsurface waters in the indicated part of Czechoslovakia during 76 years. (Sims-ISWS)
W79-06609

ALTERATION OF HYDROGEOLOGIC CONDITIONS DURING MINING OF MINERAL DEPOSITS AND WATER-RESOURCE CONSERVATION MEASURES,
All-Union Scientific Research Inst. of Hydrogeology and Engineering Geology (USSR).
For primary bibliographic entry see Field 5G.
W79-06615

ANALYTICAL STUDY OF THE OGALLALA AQUIFER IN GAINES COUNTY, TEXAS, PROJECTIONS OF SATURATED THICKNESS, VOLUME OF WATER IN STORAGE, PUMPAGE RATES, PUMPING LIFTS, AND WELL YIELDS,
Texas Dept. of Water Resources, Austin.
For primary bibliographic entry see Field 7C.
W79-06738

MORPHOLOGY AND WATER REGIME OF A DOTHAN SOIL,
Soil Conservation Service, Auburn, AL.
R. L. Guthrie, and B. F. Hajek.
Soil Science Society of America Journal, Vol. 43, No. 1, p 142-144, January-February 1979. 2 fig, 3 tab, 10 ref.

Descriptors: *Water levels, *Groundwater, *On-site investigations, *Perched water, *Alabama, Soils, Water level fluctuations, On-site tests, Methodology, Soil horizons, Measurement, Instrumentation, Precipitation(Atmospheric), Dothan soil, Mottled soils, Plinthite.

The water regime in a Dothan soil was characterized by installing piezometers at 137-, 183-, and 285-cm depths. Monthly water table measurements differed for each piezometer throughout a 4-year study period, indicating a perched water table. There was a water table at the greatest depth on only 5 occasions during the study period. On all but a few occasions, a water table was encountered at the 2 shallower depths. Morphological properties and seasonal precipitation were related to the water regime. The perched water table fluctuated in a continuous zone of saturation in the B horizon above the horizons containing appreciable amounts of plinthite. A discontinuous zone of saturation was bounded on the bottom by the B3 horizon. The piezometer that had perforations in the C horizon showed no water table, which indicated that a 'dry' zone exists between the perched and regional groundwater tables. Fluctuations in the depth to perched water corresponded to seasonal precipitation patterns. (Humphreys-ISWS)
W79-06742

A DRAINAGE MODEL FOR A RECLAIMED SURFACE MINE,
Iowa State Univ., Ames. Dept. of Agronomy.
For primary bibliographic entry see Field 4A.
W79-06743

PUBLIC GROUNDWATER SUPPLIES IN MORGAN AND SCOTT COUNTIES,
Illinois State Water Survey, Urbana.
For primary bibliographic entry see Field 7C.
W79-06768

PUBLIC GROUNDWATER SUPPLIES IN PIKE COUNTY,
Illinois State Water Survey, Urbana.
For primary bibliographic entry see Field 7C.
W79-06769

THAT SINKING FEELING.
Ground Water Age, Vol. 13, No. 8, p 23-24, 42, April, 1979.

Descriptors: *California, *Land subsidence, *Artesian heads, Groundwater, Pumping, Damages, Flood control, Levees, Recharge, Compaction.

The central third of the Santa Clara Valley in California experienced one to eight feet of subsidence from 1934 to 1967 due to withdrawal of ground water from a confined aquifer. Changes in rate and magnitude of artesian head decline caused geographic variations in subsidence rate and magnitude with time. Subsidence has necessitated construction of levees near the coast, repairing damaged wells, railroads, bridges, and roads, establishing and releveling a bench mark network, and making private engineering surveys. To date, $15-20 million have been spent on these problems. Between 1967 and 1975 artesian head recovered 104 feet due to increased water imports, favorable local water supply, decreased pumpage, and increased recharge. The most significant factor was the increase of imports from 30,000 to 148,000 acre feet per year. The rate of subsidence decreased to a fraction of an inch per year as a result of the dramatic head recovery. Compaction is irreversible but by raising the artesian head in the aquifers until it equals or exceeds the maximum pore pressure in the aquitards, additional compaction and subsidence can be stopped. (Purdin-NWWA)
W79-06804

HYDROGEOLOGICAL TESTING ASSOCIATED WITH UNDERGROUND COAL GASIFICATION,
Alberta Research Council, Edmonton. Ground Water Div.
For primary bibliographic entry see Field 8E.
W79-06806

ON THE AQUIFER'S INTEGRATED BALANCE EQUATIONS,
Princeton Univ., NJ. Dept. of Civil Engineering.
J. Bear.
Advances in Water Resources, Vol. 1, No. 1, p 15-23, September 1977. 11 ref, append.

Descriptors: *Aquifers, *Balance equations, *Continuity equation, *Hydrodynamics, *Dispersion, Methodology, Transport phenomena, Porous media, Water flow, Solutes, Groundwater.

A general methodology is presented for describing transport phenomena in porous media at a macroscopic level. Then, these macroscopic balance equations are integrated (or averaged) along the vertical for confined, leaky and phreatic aquifers. The results are employed to derive (averaged) aquifer equations for the flow of water and of a solute (hydrodynamic dispersion). It is shown that in all cases, the resulting equation is identical to that derived on the basis of an assumption of horizontal flow (the Dupuit assumption). Macrodispersion, occurring at the aquifer level, is discussed and appropriate coefficients are proposed. (Bell Graf-Cornell)
W79-06811

GROUND-WATER LEVELS IN NEW MEXICO, 1976,
Geological Survey, Albuquerque, NM. Water Resouces Div.
J. D. Hudson.
New Mexico State Engineer Basic Data Report, 1978. 184 p, 35 fig, 56 tab.

Descriptors: *Groundwater levels, *New Mexico, *Water wells, *Water level fluctuations, *Hydrographs, Geologic units, Springs, Artesian heads, Groundwater resources, Bibliographies, Publications.

Water levels are measured periodically in a network of about 5,000 observation wells to record changes in ground-water storage in New Mexico. About 1,000 wells are measured annually and the remaining 4,000 wells are scheduled to be measured at 5-year periods, staggered so that a portion are measured each year. The areas of water-level observation are within seven of the nine major surface-water drainage basins; most are in areas where ground water is used in large quantities for irrigation, municipal, or industrial purposes. Measurements tabulated in this report were made in January through May 1977, except the Tatum-Lovington-Hobbs area in Lea and Chaves Counties, which has both 1977 and previously unreported 1976 water levels. Maps show water-level changes for most of the areas reporting 5-year water-level changes. The program of groundwater observation conducted by the U.S. Geological Survey is in cooperation with the State Engineer of New Mexico; resulting data are used in evaluating the ground-water resources of the State. Included is a bibliography of papers and publications pertaining to ground water in New Mexico published or released to the open file in 1976, with additions from 1873-1975. (Woodard-USGS)
W79-06828

THE OCCURRENCE, AVAILABILITY, AND CHEMICAL QUALITY OF GROUND WATER, GRAND STRAND AREA AND SURROUNDING PARTS OF HORRY AND GEORGETOWN COUNTIES, SOUTH CAROLINA,
Geological Survey, Columbia, SC. Water Resources Div.
For primary bibliographic entry see Field 7C.
W79-06831

SOME PROBLEMS IN EVALUATING THE ABILITY OF STRATA TO STORE OR TRANSMIT POLLUTANTS,
Manchester Univ. (England). Dept. of Civil and Structural Engineering.
For primary bibliographic entry see Field 5B.
W79-06862

FORMATION FINES AND FACTORS CONTROLLING THEIR MOVEMENT IN POROUS MEDIA,
Exxon Production Research Co., Houston, TX.
T. W. Muecke.
Journal of Petroleum Technology, Vol. 31, No. 2, p 144-150, February 1979. 11 fig, 1 tab, 5 ref.

Descriptors: *Wells, *Clogging, *Porous media, Migration, Fines, Sand aquifers, Unconsolidated aquifers, Sandstones.

Unconsolidated sandstone formations contain large amounts of very small, loose, solid particles that vary widely in size and chemical composition. These particles can concentrate at pore restrictions causing severe plugging and reductions in formation permeability. The effects of single-and multiphase fluid flow on fine-particle movement in porous media are discussed. The onset of water production can cause fines to move and lead to well productivity problems. Injection of water or solvent, surfactant solutions often leads to at least temporary removal of near-wellbore damage. Chemical systems designed to permanently remove or stabilize fine particles must be capable of treating a broad range of particles having widely different compositions. Besides mechanical bridging, particle wettability and surface/interfacial forces strongly influence particle mobility when multifluid phases are present. Particles will move only if the phase that wets them is moving. Thus, it may be possible to control fines movement with permanent coatings of the right material on sand grain surfaces. (Purdin-NWWA)
W79-06864

GROUNDWATER LEVELS AND PUMPAGE IN THE EAST ST. LOUIS AREA, ILLINOIS, 1972-1977,
Illinois State Water Survey, Urbana.
J. T. Emmons.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-296 043, Price codes: A03 in paper copy, A01 in microfiche. Circular 134, 1979. 23 p, 17 fig, 4 tab, 6 ref, 1 append.

Descriptors: *Groundwater, *Illinois, *Data collections, *Mississippi River, *Water levels, Discharge(Water), Groundwater resources, Water supply, Aquifers, Sand aquifers, Alluvial aquifers, Water table aquifers, Municipal water, Domestic water, Well data, Potentiometric level, Surface waters, Water wells, *Alton(IL), *Wood River(IL), *Granite City(IL), *National City(IL), *Monsanto(IL).

Groundwater levels and pumpage in the East St. Louis area from 1972 through 1977 were considered in this report. Large quantities of groundwater chiefly for industrial and municipal use were withdrawn from wells penetrating a sand and gravel aquifer along the valley lowlands of the Mississippi River. Groundwater pumpage decreased from 79.5 million gallons per day (mgd) in 1971 to 65.3 mgd in 1977. Of the total 1977 pumpage, 79% was industrial; 16% was for public water supplies; 3.7% was for domestic use; and 1.3% was for irrigation. Pumpage in the East St. Louis area is concentrated in 5 major pumping centers: the Alton, Wood River, Granite City, National City, and Monsanto areas. As a result of reduced groundwater pumpage, near normal precipitation, and high Mississippi River stages, water levels rose as much as 35 feet in the Monsanto area near the Mississippi River and 15 feet in the Alton area. As a result of decreased pumpage in one area and increased pumpage in another area, water levels in the Granite City area rose 5 feet in one location and declined 5 feet in another location. In the National City area, water levels rose 10 feet in one area and declined 10 feet in another area. In the Wood River area, water levels rose 20 feet in one area because an industry changed the location of its groundwater source. (Humphreys-ISWS)
W79-06890

NUMERICAL MODEL FOR LAND SUBSIDENCE IN SHALLOW GROUND WATER SYSTEMS,
California Univ., Berkeley. Lawrence Berkeley Lab.
T. N. Narasimhan, and P. A. Witherspoon.
Publication No. LBL-4461, December 1976. 10 p, 12 fig, 10 ref.

Descriptors: *Finite difference analysis, *Land subsidence, *Compaction, Aquifers, Groundwater, Porous media, Flow systems.

The finite difference method is employed to simulate compaction of aquifers due to withdrawal of ground water. The model combines a general three-dimensional fluid flow field with a one-dimensional, vertical deformation of the porous medium. The governing equation is solved using a mixed explicit-implicit iteration scheme for advancing in the time domain. The model can handle heterogeneous flow regions with complex geometry, and with time dependent variation of material properties and boundary conditions. Five hypothetical cases are provided to demonstrate the applicability of the model to the wide variety of conditions associated with land subsidence. (Purdin-NWWA)
W79-06912

ELECTRO-OSMOSIS IN GROUND WATER POLLUTION CONTROL,
California Univ., Santa Barbara. Dept. of Mechanical and Environmental Engineering.
For primary bibliographic entry see Field 5G.
W79-06913

APPROXIMATE ANALYSIS OF UPCONING,
Princeton Univ., NJ. Dept. of Civil Engineering.
H. Rubin, and G. F. Pinder.
Advances in Water Resources, Vol. 1, No. 2, p 97-101, December 1977. 3 fig, 4 ref.

Descriptors: *Upconing, *Saline water-freshwater interfaces, *Coastal aquifers, *Groundwater, *Flow, *Salinity distribution, Effects, Wells, Equations, Free surface flow, Unsteady state, Cylindrical coordinates, Pumping, Dispersion.

The change of the salinity distribution in coastal aquifers due to pumpage is often described as an upconing of the interface between saline and fresh water. Sea and fresh water are miscible fluids, however. Therefore, dispersion of salinity in the aquifer affects the upconing process. An estimate of the effect of salinity dispersion on the dynamics of the flow as well as on the salinity distribution in the aquifer is presented herein. The phenomenon is described as a migration of sharp interface perturbed by small disturbances due to salinity dispersion. The creation of the mixing zone between fresh and saline water is described as a formation of a boundary layer in the vicinity of the sharp interface. This method is primarily recommended for the flow fields in which simple representation of the sharp interface migration is obtainable. (Bell-Graf Cornell)
W79-06920

SIMULATION OF GROUNDWATER FLOW AND MASS TRANSPORT UNDER UNCERTAINTY,
Princeton Univ., NJ. Water Resources Program.
D. H. Tang, and G. F. Pinder.
Advances in Water Resources, Vol. 1, No. 1, p 25-30, September 1977. 3 fig, 11 ref.

Descriptors: *Groundwater, *Flow, *Simulation analysis, *Mass transport, *Uncertainty, Stochastic processes, Analytical techniques, Waves(Water), Probability, Wells, Equations, Systems analysis, Contaminant transport, Perturbation approach.

An analytical tool which facilitates the analysis of stochastic groundwater problems without resorting to Monte Carlo analysis can be developed using an approach analogous to that used in the field of applied mathematics to investigate the propogation of waves in random media. The fundamental as-

sumption of this approach is that the random part of the porous medium property is small compared to the non-random part. This assumption allows us to treat the problem of solving a partial differential equation with stochastic coefficients using perturbation theory. (Bell Graf-Cornell)
W79-06922

2G. Water In Soils

SURFACE STORAGE ON BEDDED CULTIVATED LANDS,

North Carolina State Univ. at Raleigh. Dept. of Biological and Agricultural Engineering.
G. A. Gayle, and R. W. Skaggs.
Transactions of the American Society of Agricultural Engineers, Vol. 21, No. 1, p 101-109, January-February 1978. 5 fig, 2 tab, 8 ref. OWRT-A-086-NC(5). 14-34-0001-7070.

Descriptors: *Storage, *Depression storage, *Runoff, *North Carolina, *Drainage, Soils, *Storage capacity, Infiltration, Evaporation, Surfaces, Water storage, Rainfall, Precipitation(Atmospheric), Agriculture, Farm management, On-site investigations, Hydrology, Micro-storage, Macro-storage.

Surface depressional storage was characterized for three field soils by measuring both micro and macro components at various times during the year. Measurements were made on both land formed and non-land formed fields. Micro-storage was measured by sealing the soil surface in small plots and determining the amount of water that could be applied before runoff began. The macro-storage component was measured by closely spaced surface elevation measurements. The range in macro-storage was from 1.1 mm for a land-formed soil to 33 mm for a natural sloped field. The micro-storage was dependent on soil type, slope, and time of year, but ranged from 0.6 to 19 mm. Based on the cases examined, flat lands in the North Carolina Tidewater Region may be expected to have macro-storage values of about 15 mm or greater under natural conditions. When potholes are eliminated, either by land forming or simply filling the depressions, macro-storage can be reduced to less than 5 mm. (Sims-ISWS)
W79-06503

SERIOUS INTERFERENCES IN THE DETERMINATION OF TRACE METALS IN SOILS BY FLAME AND FLAMELESS ATOMIC ABSORPTION SPECTROMETRY,

Montana Coll. of Mineral Science and Technology, Butte. Dept. of Chemistry.
A. Mubarak, L. Hageman, R. A. Howald, and R. Woodriff.
Soil Science Society of America Journal, Vol 42, No 6, p 889-891, November-December, 1978. 5 tab, 14 ref.

Descriptors: *Trace elements, *Spectrometers, Chemical analysis, *Soil chemistry, Absorption.

Negative interfering effects on the carbon rod atomizer (CRA) absorbances of Mn, Fe, and Ni were found to occur in the presence of the chlorides of the major cations (Ca, Mg, Na) in the soil solution. These interferences were corrected either by precipitation of the chlorides with silver nitrate or by incorporating a relatively high level of sulfuric or nitrice acid into the sample volume. Magnesium ion, irrespective of the associated anion, was found to lower the Cd signal on the CRA. High concentrations of MgSO4 caused lowering of the Mn signal when using air-acetylene flame. This lowering effect of MgSO4 was avoided upon using N2O-acetylene flame. No interferences were noticed for Mn and Zn when using the constant temperature furnace developed at Montana State University. (Skogerboe-Colorado State)
W79-06555

OXYGEN FLUX MEASUREMENT IN UNSATURATED SOILS,

Malcomess Ltd., Isando (South Africa).
J. M. Rankin, and M. E. Sumner.
Soil Science Society of America Journal, Vol 42, No 6, p 869-873, November-December, 1978. 3 fig, 3 tab, 12 ref.

Descriptors: *Oxygen, *Soil gases, Diffusion, Aeration, Deaeration, Oxidation-reduction potential, Electrodes, Instrumentation, Electrical resistance.

Because in unsaturated soil systems the plateau of the current-voltage curve is not well developed or is absent, O2 reduction at the platinum microelectrode is not diffusion controlled and consequently measured current depends continuously on applied potential. To overcome this difficulty an O2 flux meter was designed which carefully controls and measures the applied potential and enables the effective potential at the electrode to be measured precisely. The instrument, which has facilities for measuring soil electrical resistance, electrode redox potential, and O2 reduction current was fully described together with a circuit diagram. Because the surface oxide condition of the microelectrode is crucial to reproducible results, electrode pretreatment involving gentle abrasion in wet fine sand is necessary to standardize conditions prior to measurement. The results showed that the instrument is suitable for measuring O2 flux in unsaturated systems, and that measured current was closely related to soil airspace. (Skogerboe-Colorado State)
W79-06556

A UNIVERSAL DIMENSIONLESS PHOSPHATE ADSORPTION ISOTHERM FOR SOIL,

Arya-Mehr Univ. of Technology, Tehran (Iran).
A. Shayan, and B. G. Davey.
Soil Science Society of America Journal, Vol. 42, No. 6, p 878-882, November-December, 1978. 3 fig, 1 tab, 20 ref.

Descriptors: *Adsorption, *Phosphates, Isotherms, Kaolinite, Chemical potential, Fertilizers, Soil chemistry.

A unique dimensionless phosphate adsorption isotherm, covering the solution concentration range 0.000001 to 0.1M P, which has been found to fit 17 materials including 15 soils, pure kaolinite and amorphous Al(OH)3, was derived. The soils shown to fit the isotherm included chromic luvisols, pellic vertisols, calcic luvisols, a tropeptic eutrorthox, a volcanic ash soil from New Zealand, and a number of English soils. The necessary parameters to derive a complete adsorption isotherm for a particular soil, from the universal isotherm, required three adsorption experiments in the high concentration range (0.000001 to 0.0001M P) to define the linear portion of the isotherm and the critical concentration. Three other determinations in the range 0.000001 to 0.0001M P were needed to obtain the Freundlich isotherm from the data after correction for the effect of the linear region of the isotherm at high concentration. The advantage of this universal isotherm over conventional isotherms, is that it requires less experimental work to define and is applicable over a wide range of P concentrations such as might be found surrounding a fertilizer granule. (Skogerboe-Colorado State)
W79-06557

TRANSIENT SEEPAGE ANALYSIS OF GURI DAM,

Harza Engineering Co., Chicago, IL. Hydrology Analysis and Design Div.
For primary bibliographic entry see Field 8A.
W79-06587

VARIABLE DRAINABLE POROSITY IN DRAINAGE DESIGN,

Indian Agricultural Research Inst., New Delhi (India). Div. of Engineering.
A. K. Bhattacharya, and R. S. Broughton.
Journal of the Irrigation and Drainage Division, American Society of Civil Engineers, Vol. 105, No. IR1, Proceedings Paper 14433, p 71-85, March 1979. 6 fig, 7 tab, 25 ref, 2 append.

Descriptors: *Drainage, *Soil water, *Porosity, On-site investigations, Laboratory tests, Soil moisture, Soil water movement, Water table, Water levels, Soils, Clays, Sands, Soil properties, Bulk density, Subsurface drainage, Tensiometers, Hydraulic transients, Hydraulic conductivity, Soil science.

Field and laboratory investigations were done to study the dependence of drainable porosity on the suction in two different types of soil. Empirical nonlinear relationships were developed between the two. These relations were different for the sand and the clay soils. The relations were integrated between various limits to obtain the volume of water drained from saturated soil columns for different water table drawdowns. The results thus obtained were used to derive water table, depth-transient water content relations for soil columns of known lengths. These relations can be used to predict water table depth from the known value of transient water content in a soil column, in the water balance approach for subsurface drainage design. The effect of depth of installation of subsurface drains on the soil moisture depletion in coarser soils was examined. (Sims-ISWS)
W79-06605

THE EFFECT OF DISCHARGE RATE AND INTERMITTENT WATER APPLICATION BY POINT-SOURCE IRRIGATION ON THE SOIL MOISTURE DISTRIBUTION PATTERN,

Agricultural Research Organization, Bet Dagan (Israel). Inst. of Soil and Water.
I. Levin, P. C. van Rooyen, and F. C. van Rooyen.
Soil Science Society of America Journal, Vol. 43, No. 1, p 8-16, January-February 1979. 9 fig, 4 tab, 14 ref.

Descriptors: *Soil water, *Irrigation, *Model studies, *On-site investigations, *Laboratory tests, Soil water movement, Diffusivity, Distribution patterns, Soil moisture, Hydraulic conductivity, Soils, Wetting, Mathematical models, Computer models, Water loss, Evaporation, Point-source irrigation, Trickle irrigation.

A comparison was made between the results of laboratory and field experiments regarding predictions of soil moisture distribution from a point source and those predictions theoretically calculated by a computer simulation model. Good agreement was found between computed and experimental data. When the verified model was used for predictions regarding soil water distribution under point-source irrigation, it was found that when the same total amount of water (12 liters) was added to the soil with a 2, 4, or 8 liters/hour continuously applied trickle source, a loss of 26% of the total amount applied was effected below the 60 cm depth after 12 hours. The initial water content of the soil was adjusted to the field capacity value. Under identical conditions, 1 liter/hour continuously applied and 2 liters/hour pulsed (intermittent) irrigation resulted in only a 12% loss. The lateral distribution of the water showed that in the first group of treatments, 80% of the water in the wetted soil volume was distributed 45 and 43 cm horizontally from the point source after 12 and 24 hours respectively. In the second group of treatments, the distribution was to 29 and 40 cm. Thus, the second group of treatments showed a clear advantage in reducing water loss under the root zone while still not significantly affecting the horizontal distribution. The pulse treatment, therefore, can replace the advantageous low (1 liter/hour) discharge rate while to a large extent avoiding the difficulties of blocking of outlets by maintaning a higher (2 liter/hour) discharge rate. (Sims-ISWS)
W79-06660

FLOW PATTERNS DURING EXTENDED SATURATED FLOW IN TWO, UNDISTURBED SWELLING CLAY SOILS WITH DIFFERENT MACROSTRUCTURES,

Soil Survey Inst., Wageningen (Netherlands).
J. Bouma, and J. H. M. Wosten.
Soil Science Society of America Journal, Vol. 43, No. 1, p 16-21, January-February 1979. 6 fig, 1 tab, 18 ref.

Descriptors: *Soils, *Soil water, *Laboratory tests, Soil water movement, Porosity, Pores, Clays, Saturated flow, Saturated soils, Data processing, Analytical techniques, Soil science, Breakthrough curves, Swelling soils, Soil columns, Soil macrostructure.

Large, undisturbed soil columns with an average height of 30 cm, a diameter of 25 cm, and with two different types of macrostructure were sampled in moist clay soil. Type 1 had vertical worm channels and 'rough' peds; type 2 had no worm channels and 'smooth' peds. Flow patterns were characterized by repeatedly measuring K sub sat and chloride breakthrough curves. Effective pore size distributions were calculated from the latter with the Klinkenberg procedure. Initial chloride breakthrough was most rapid in soil columns of type 1 after displacement of less than 1 vol. % of the initial water, whereas 3 vol. % was displaced in type 2. Rapid chloride breakthrough was associated with a high volume of immobile water (60 vol. % and 2 vol. % for types 1 and 2 respectively). These phenomena can be explained by the presence of relatively large, continuous pores (particularly in type 1), that occupy only a small volume, as was confirmed by micromorphometric analysis and calculations of effective pore diameters. Application of a gypsum crust on soil columns of type 1 erased the differences with type 2. Crusts induced pressure potentials of -5 mbar, thus excluding the largest pores only. Extended ponding and associated continued swelling of peds did not change flow phenomena in type 1; in type 2, K sub sat, the volume of immobile water and the effective pore diameters gradually decreased. Equivalent pore diameters, calculated from the soil moisture characteristic, were quite different from the effective diameters and could not be used to independently predict the breakthrough curves. (Sims-ISWS)
W79-06661

EVALUATION OF CONCEPTUAL MODELS FOR DESCRIBING NONEQUILIBRIUM ADSORPTION-DESORPTION OF PESTICIDES DURING STEADY-FLOW IN SOILS,
Florida Univ., Gainesville. Dept. of Soil Science.
P. S. C. Rao, J. M. Davidson, R. E. Jessup, and H. M. Selim.
Soil Science Society of America Journal, Vol. 43, No. 1, p 22-28, January-February 1979. 6 fig, 4 tab, 23 ref. EPA R-803849.

Descriptors: *Pesticides, *Herbicides, *Soils, *Adsorption, Soil water, Soil water movement, Solutes, Model studies, Mathematical models, Laboratory tests, Pollutants, Path of pollutants, Water pollution, Soil science, Breakthrough curves.

Breakthrough curves (BTC) from miscible displacement of 2 pesticides through 3 soils were measured for 2 input concentrations of each pesticide. These BTC data were used to evaluate 2 conceptual models for describing the nonequilibrium adsorption-desorption of pesticides in soils under steady-state water flow conditions. In both models, adsorption on one group of sites was assumed to be instantaneous, while the rate of adsorption on the second group of sites followed either nonlinear reversible kinetics (Model I) or was a diffusion-controlled process (Model II). Parameters in both models were estimated by curve-fitting model predictions to one set of measured BTC data using a nonlinear least-squares optimization procedure. These parameter values then were used to verify the conceptual models by comparing simulated and measured BTC for a different input concentration. A different set of model parameters were required to describe the BTC data for each input concentration for the same soil-pesticide combination. The measured 3H20 BTC for all 3 soils were symmetrical in shape with no apparent tailing. Evaluation of Model I and II using these BTC suggested that the mobile-immobile water concept may not be applicable to the three soils used in this study. (Sims-ISWS)
W79-06662

SEASONAL WATER USE BY WINTER WHEAT GROWN UNDER SHALLOW WATER TABLE CONDITIONS,
Govind Ballabh Pant Univ. of Agriculture and Technology, Pantnagar (India).
B. C. Saini, and B. P. Ghildyal.
Agricultural Water Management, Vol 1, No 3, p 263-276, November, 1978. 10 fig, 1 tab, 27 ref.

Descriptors: *Water requirements, *Soil water movement, Shallow water, Moisture tension, Moisture content, Root zone, Tensiometers, Moisture deficit, *Wheat.

Techniques for estimating seasonal water use from soil profile water depletion frequently do not account for flux below the root zone. A method using tensiometers for obtaining evapotranspiration losses from the root zone and water movement below it was discussed. Soil water flux below the root zone was approached by a sequence of pseudo steady state solutions of the flow equation. Upward soil water flux contributed 36 to 73% to the total water requirement of winter wheat (Triticum aestivum L.) whereas soil water depletion accounted for 11 to 19% only. Water use efficiency with one irrigation during an early stage of plant development was greater than with no or three irrigations. This was the result of both decrease of resistance due to soil moistening and better root development. Tensiometer readings were also interpreted to estimate root zones, water table depths and soil moisture contents. Methods described in this paper can be used in determining seasonal water use by growing crops, replacing or supplementing lysimeter or meteorology approaches to this problem. (Skogerboe-Colorado State)
W79-06691

CONVECTIVE TRANSPORT OF SOLUTES BY STEADY FLOWS I. GENERAL THEORY,
Institute for Soil Fertility, Groningen (Netherlands).
P. A. C. Raats.
Agricultural Water Management, Vol. 1, No. 3, p 201-218, November, 1978. 3 fig, 1 tab, 10 ref.

Descriptors: *Soil water movement, Solutes, Convection, Steady flow, Theoretical analysis, Anisotropy, Travel time, Leaching.

A comprehensive theory describing convective transport of solutes was presented. The time required for a parcel of water to move from one point to another along a streamline was determined, and this basic information was then used to describe collections of parcels of water forming a surface. Input/output relationships were determined in terms of the distribution of the solute over the inflow and outflow surfaces. A simple geometric transformation was used to extend the theory to anisotropic media. (See also W79-06693) (Skogerboe-Colorado State)
W79-06692

CONVECTIVE TRANSPORT OF SOLUTES BY STEADY FLOWS II. SPECIFIC FLOW PROBLEMS,
Institute for Soil Fertility, Groningen (Netherlands).
P. A. C. Raats.
Agricultural Water Management, Vol. 1, No. 3, p 219-232, November, 1978. 5 fig, 31 ref.

Descriptors: Soil water movement, Solutes, Convection, Steady flow, Drainage, Leaching, Flow characteristics, Flow system, Travel time.

A comprehensive theory describing convective transport of solutes was presented in Part I (See W79-06692). In this paper the general theory was applied to specific flow problems. The relatively simple problem of leaching to drains and ditches induced by an input distributed uniformly over the surface was discussed in detail. If the ratio of the halfspacing between the drains or ditches and the depth to the impermeable layer is larger than about five, density distribution is approximately exponential. The general theory was also used to evaluate the literature on many other problems. (Skogerboe-Colorado State)
W79-06693

DETERMINATION OF THE APPARENT DISPERSION COEFFICIENT OF SOLUTES IN UNSATURATED SOIL,
Arkansas Univ., Fayetteville. Dept. of Agronomy.
R. F. Paetzold, and H. D. Scott.
Soil Science Society of America Journal, Vol. 42, No. 6, p 874-877, November-December 1978. 3 fig, 1 tab, 14 ref. OWRT A-039-ARK(1).

Descriptors: *Dispersion, *Solutes, *Soil water movement, Tracers, Laboratory tests, Moisture content, Radioisotopes, Pesticides, Herbicides, Unsaturated flow, Dispersion coefficients.

A method for determining the apparent dispersion coefficient of a solute in unsaturated soils at relatively low soil water flow rates was presented. Two soil cores with different initial water contents were joined, and water was allowed to flow between the soil cores for a specified time interval. The distribution of a radioactively tagged solute, initially present in one of the soil cores, subsequently was determined by freezing the cores in liquid air, sectioning the soil with a refrigerated microtome, and analyzing the soil sections for solute content using liquid scintillation techniques. Apparent dispersion coefficients could be determined either with or against the water flow. The solutes used in this study were tritiated water, chloride, and metribuzin (a herbicide). (Sims-ISWS)
W79-06723

MORPHOLOGY AND WATER REGIME OF A DOTHAN SOIL,
Soil Conservation Service, Auburn, AL.
For primary bibliographic entry see Field 2F.
W79-06742

WATER AND SALT MOVEMENT IN UNSATURATED FROZEN SOIL: PRINCIPLES AND FIELD OBSERVATIONS,
Science and Education Administration, Kimberly, ID. Snake River Conservation Research Center.
J. W. Cary, R. I. Papendick, and G. S. Campbell.
Soil Science Society of America Journal, Vol. 43, No. 1, p 3-8, January-February 1979. 6 fig, 1 tab, 18 ref.

Descriptors: *Soil water movement, *Unsaturated flow, *Soil temperature, *Infiltration, *Salts, Frost heaving, Heat flow, Mathematical model, Equations, Hydraulic conductivity, Theoretical analysis, Electrical conductance, Percolation, Model studies, Salt movement.

Soil temperatures, electrical conductivities, and water redistribution were measured at 4 field sites during a 30-day period in which the soil was never completely thawed. The soil on each site was a silt loam with varying aspects and vegetation covers. Both upward and downward flows of water and solutes were observed. The assumption that liquid water flow in frozen soil is analogous to unsaturated liquid flow in unfrozen soil, led to a simple equation that, in general, agreed with the field observations. The equation requires knowledge of the soil temperatures, the solute concentrations, and 2 constants that characterize the soil's water release curve and saturated hydraulic conductivity. Infiltration and frost heaving were discussed with respect to this simple theory. Water in frozen soil flows from high to low temperatures and from high to low salt concentrations. Consequently, solutes in eve very low salt soils are important in decreasing frost heave and increasing infiltration. The liquid flow is so closely coupled with temperature that heat flow must be considered simultaneously in any comprehensive analysis. This coupling, as expressed in the simple liquid flow equation, accounts for the effect of soil water content on frost heave rates and the effects of temperature on maximum heaving pressures. (Visocky-ISWS)
W79-06744

AN ATTEMPT AT EXPERIMENTAL VALIDATION OF MACROSCOPIC-SCALE MODELS OF SOIL MOISTURE EXTRACTION BY ROOTS,
Louvain Univ. (Belgium). Lab. of Soil Physics.
C. Belmans, J. Feyen, and D. Hillel.
Soil Science, Vol 127, No 3, p 174-186, March 1979. 12 fig, 33 ref.

Descriptors: *Soil moisture, *Model studies, *Root systems, *Water utilization, Resistance networks, Soil-water-plant relationships, Water table, Absorption, Equations, Hydraulic conductivity, Computer programs, Macroscopic-scale models, Root resistance, Ryegrass.

An experiment was conducted to test the validity of mechanistic simulation model describing the process of soil moisture extraction by root systems, and to assess the quantitative importance of root hydraulic resistance in this process. Close-growing stands of ryegrass were raised in tubes packed with sand and loam, with and without the presence of a water table. The pattern of water uptake was monitored by gamma-ray scanning and tensiometry. Correspondence between measured and independently predicted uptake patterns could be greatly improved by assigning a relatively high value of root resistivity. Further improvement of the mechanistic model's predictive capability may require explicit formulation of conductive (axial) resistance in addition to absorptive (radial) resistance, as well, perhaps, as such important subsidiary factors as aeration, mechanical impedance, and distribution of nutrients in the soil profile. (Visocky-ISWS)
W79-06745

RESULTS OF LYSIMETER TRIALS AT THE LIMBURGERHOF FACILITY 1927-1977; THE MOST IMPORTANT FINDINGS FROM 50 YEARS OF EXPERIMENTS,
Badische Anilin-und Soda Fabrik A.G., Ludwigshafen am Rhein (Germany, F.R.). Landwirtschaftliche Versuchsstation.
S. Jurgens-Gschwind, and J. Jung.
Soil Science, Vol. 127, No. 3, p 146-160, March 1979. 13 fig, 4 tab, 24 ref.

Descriptors: *Lysimeters, *Percolation, *Soil water, *Nutrients, Nitrogen, Phosphorus, Potassium, Magnesium, Crops, Vegetation, Vegetation effects, Leaching, Fertilizers, Agriculture, Rainfall, Soils, Soil science, Laboratories, Data collections, Laboratory tests, *West Germany.

BASF's lysimeter facility at Limburgerhof was 50 years old in 1977. Approximately 130,000 percolate samples from 232 outdoor plots have been removed and measured there to date. About 1.5 million analyses of substances in soil and percolate have been carried out, as have about 190,000 analyses of substances in crops. Thirty-nine publications on the subjects of fertilization and crop protection provide evidence of the comprehensive work in agricultural chemistry, as well as in crop and environmental protection. These publications discuss nutrient supply and nutrient behavior in the soil and their relation to the most varied growing conditions. The speed with which the substances migrate in the soil and their degradation are of special importance when studying the active ingredients of crop protection. The numerous results at Limburgerhof were summarized. (Sims-ISWS)
W79-06746

EVAPOTRANSPIRATION BED DESIGN,
Goodson (Raymond L.) Inc., Dallas, TX.
For primary bibliographic entry see Field 2D.
W79-06748

SOIL MOISTURE VARIATION UNDER BARE CONDITIONS AT PUNE AND DELHI IN RELATION TO RAINFALL,
Meteorological Office, Poona (India).
B. C. Biswas.
Indian Journal of Meteorology, Hydrology and Geophysics, Vol 29, No 3, p 555-560, July 1978. 2 fig, 2 tab, 7 ref.

Descriptors: *Soil moisture, *Rainfall, *Variability, Soils, Soil types, Soil water, Precipitation(Atmospheric), Monsoons, Crops, Agronomy, Agriculture, Soil science, Meteorological data, Climatology, *India, *Pune(India), *New Delhi(India).

Soil moisture variation in bare soil of various depths at Pune and Delhi was examined week by week. The study brought out that soil moisture reaches field capacity at Pune on a few occassions and almost every year at Delhi area specially in late monsoon. There may not be any carry over of moisture for the next season at Pune but forced fallows may benefit the succeeding crop at Delhi. (Sims-ISWS)
W79-06750

THE INFLUENCE OF ELECTROLYTE CONCENTRATION ON FLOCCULATION OF CLAY SUSPENSIONS,
California Univ., Riverside. Dept. of Soil and Environmental Sciences.
H. S. Arora, and N. T. Coleman.
Soil Science, Vol. 127, No. 3, p 134-139, March 1979. 1 fig, 5 tab, 20 ref.

Descriptors: *Electrolytes, *Clays, *Flocculation, *Suspension, *California, Dispersion, Clay minerals, Hydraulic conductivity, Alkaline soils, Illite, Kaolinite, Cations, Soils, Sodium adsorption ratio, Concentration.

The influence of mineralogical composition, saturating ions, and electrolyte concentration on the flocculation and dispersion behavior of various clay minerals was used to explain reductions in the hydraulic conductivity observed in many sodic soils containing little or no expandable clay minerals. Sodium-saturated clay minerals were found to differ in their sensitivity to flocculation by NaHCO3 in the decreasing order: illite, vermiculite, smectite, and kaolinite. Critical salt concentrations (CSC) were 185, 58, 28 to 60, and 8 me/liter, respectively, for the above clays. Very low concentrations of CaCl2 or MgCl2, on the order of 1 me/liter or less, were required to flocculate Ca- or Mg-saturated clays. At a sodium adsorption ratio of 15, CSCs were several times greater than those for CaCl2 or MgCl2. A small amount of smectite, possibly deposited on positively charged edges of kaolinite, was responsible for large increases in CSC values of kaolinite. The flocculation behavior of soil clays extracted from 4 California soils was influenced by their mineralogical composition, similar to the patterns observed for reference clay minerals. (Visocky-ISWS)
W79-06761

PERTURBATION SOLUTIONS FOR VERTICAL INFILTRATION PROBLEMS: A UNIFORMLY VALID SOLUTION,
City Coll., New York. Dept. of Mathematics.
D. K. Babu.
Advances in Water Resources, Vol. 1, No. 2, p 111-116, December 1977. 2 fig, 14 ref.

Descriptors: *Soil moisture, *Movement, *Vertical infiltration, *Perturbation, Equations, Iteration methods, Burgers equation, Unsaturated soils.

The high nonlinearities in the parabolic equations governing the movement of moisture in unsaturated homogeneous soils are a complication that is widely known and discussed in the literature. Herein, the problem of vertical infiltration is solved by means of perturbation methods. The structure of the solution exhibits uniform validity for all times and all depths. For comparison between prediction and an exact result, the Burgers equation has been selected. This equation is mildly nonlinear and hence constitutes the most unfavorably known example. (Bell Graf-Cornell)
W79-06925

2H. Lakes

SPECTRAL DISTRIBUTION OF RADIATION IN THE NORTHERN GREAT LAKES DURING WINTER,
National Oceanic and Atmospheric Administration, Ann Arbor, MI. Great Lakes Environmental Research Lab.
S. J. Bolsenga.
Journal of Great Lakes Research, Vol 4, No 2, p 226-229, June 1978. 3 fig, 3 tab, 11 ref.

Descriptors: *Radiation, *Solar radiation, *Great Lakes, *Lake Superior, On-site investigations, Instrumentation, Measurement, Clouds, Atmosphere, Water vapor, Energy, Energy transfer, Ice, Melting, Radiation spectra, Spectral distribution.

Measurements of global radiation in the spectral bands 285-2800, 535-2800, 630-2800, and 700-2800 nm were collected at the eastern end of Lake Superior during the period January through May. Significant differences were reported between the various spectral bands on a monthly as well as on a daily and hourly basis, due to varying degrees and types of cloudiness. Values of net and downward radiation for the same period were also provided. (Sims-ISWS)
W79-06596

FACTORS IN THE DETERMINATION OF SELECTED TRACE ELEMENTS IN NEARSHORE U.S. WATERS OF LAKES SUPERIOR AND HURON,
Environmental Research Lab., Duluth, MN.
For primary bibliographic entry see Field 5A.
W79-06597

MODELLING ICE DISSIPATION IN EASTERN LAKE ERIE,
State Univ. of New York at Buffalo. Dept. of Civil Engineering.
For primary bibliographic entry see Field 2C.
W79-06598

CHEMICAL LOADINGS TO SOUTHWESTERN LAKE SUPERIOR FROM RED CLAY EROSION AND RESUSPENSION,
Wisconsin Univ.-Superior. Dept. of Chemistry.
D. A. Bahnick, T. P. Markee, C. A. Anderson, and R. K. Roubal.
Journal of Great Lakes Research, Vol 4, No 2, p 186-193, June 1978. 3 fig, 2 tab, 19 ref. EPA R005169-01.

Descriptors: *Lake Superior, *Great Lakes, *Water chemistry, *Sediments, *Erosion, Clays, Sampling, Laboratory tests, Chemicals, Metals, Heavy metals, Dissolved solids, Suspended solids, Analytical techniques, Chemical analysis, Water pollution, Water pollution sources, Lakes, Limnology.

Inputs of chemical parameters were calculated from estimated erosion and resuspension data and by using experimental measurements of chemical releases from both bluff samples and Lake Superior sediments in suspensions with Lake Superior water. The ability of suspended clay particles to remove manganese and copper ions from Lake Superior water was investigated. The loadings of easily leachable dissolved solids, phosphorus, nitrogen, chloride, silica, sodium, potassium, calcium, magnesium, aluminum, and heavy metals from shoreline erosion and resuspended sediment were small compared to Lake Superior tributary inputs. Suspended sediment particles have a large capacity to remove copper and manganese ions from Lake Superior water. Each kilogram of suspended sediment particles of clay size can remove 175 mg of copper and 11 mg of manganese in Lake Superior water spiked to contain 10 microgram/L of each metal. (Sims-ISWS)
W79-06599

IDENTIFICATION OF CONTAMINANTS IN LAKE SUPERIOR THROUGH LANDSAT I DATA,
Minnesota Univ.-Duluth. Dept. of Physics.
For primary bibliographic entry see Field 5A.
W79-06600

STATISTICAL ANALYSIS OF THE 1975 INTERCOMPARISON STUDY ON LAKE ERIE,
Ohio State Univ., Columbus, Dept. of Statistics.
P. I. Feder, and J. E. Zapotosky.
Journal of Great Lakes Research, Vol. 4, No. 2, p 127-133, June 1978. 6 tab, 5 ref. EPA R-802543-01.

Descriptors: *Lake Erie, *Great Lakes, *Sampling, *Laboratory tests, Statistics, Analysis, Chemical analysis, Nutrients, Phosphorus, Nitrogen, Nitrogen compounds, Nitrates, Nitrites, Silicates, Analytical techniques, Laboratories, Lakes, Limnology, Intercomparison studies.

An intercomparison experiment was carried out at two sampling stations on Lake Erie on June 10, 1975, by 3 laboratories that are conducting environmental monitoring programs on the lake. The laboratories simultaneously collected water samples from 3 sampling depths at each station. The samples were divided into thirds, 1/3 to be analyzed by each of the laboratories using their standard procedures. A number of physical, chemical, and biological properties were determined from each of the water samples. One of the principal results of the statistical analyses is that significant differences exist for most of the properties under study, due to which laboratory analyzed the samples. However, the effect due to which laboratory obtained the samples is much less important. These results are in direct agreement with results reported in 1974 by Robertson, Elder, and Davies. (See also W76-11430) (Sims-ISWS)
W79-06601

FACTORS GOVERNING THE BIOLOGICAL PRODUCTIVITY, REGIME, AND CONTENT OF BIOGENIC AND ORGANIC SUBSTANCES IN THE SEQUENCE OF DNEPR RESERVOIRS,
Akademiya Nauk URSR, Kiev. Inst. Hydrobiologii.
For primary bibliographic entry see Field 5B.
W79-06614

DESTRATIFICATION OF LAKES USING BUBBLE COLUMNS,
Technische Hogeschool, Delft (Netherlands). Dept. of Civil Engineering.
C. Kranenburg.
Journal of the Hydraulics Division, American Society of Civil Engineers, Vol. 105, No. HY4, Proceedings Paper 14498, p 333-349, April 1979. 10 fig, 1 tab, 15 ref, 3 append.

Descriptors: *Lakes, *Destratification, *Bubbles, *Model studies, Mathematical models, Mixing, Oxygen, Dissolved oxygen, Water quality, Reservoirs, Stratification, Epilimnion, Hypolimnion, Hydraulics, Limnology, Plumes, Bubble plumes, Air injection, Bubbling pressure.

Mathematical modeling and physical modeling make possible quantitative predictions as regards the destratification process brought about by the local injection of air at the bottom of a thermally stratified lake or reservoir. The mathematical model distinguished between a near field and a far field. Mixing of epilimnion water and hypolimnion water takes place in the near field. The mixing water is accumulated in the far field as an interlayer between epilimnion and hypolimnion. The influence of wind on the mixing is not considered. The agreement between theory and model experiments is satisfactory, but further measurements in nature are needed. Increasing the number of injection points is an effective means to speed up the destratification process. Increasing the air flow rate, however, is not. (Sims-ISWS)
W79-06652

LAKE SURFACE FLUCTUATIONS AND THE MASS FLOW THROUGH THE NARROWS OF LAKE WINNIPEG,
Fisheries and Marine Service, Winnipeg (Manitoba). Freshwater Inst.
B. C. Kenney.
Journal of Geophysical Research, Vol. 84, No. C3, p 1225-1235, March 20, 1979. 12 fig, 15 ref.

Descriptors: *Mass transfer, *Canada, *Water levels, *Lakes, Fluctuations, Currents(Water), Current meters, Tides, Flow, Temperature, Water temperature, Winds, Frequency, On-site investigations, On-site data collections, Data processing, Limnology, *Lake Winnipeg(Manitoba).

Lake Winnipeg is a large (23,000 sq km), shallow (12 m), homogeneous lake composed of two well defined basins separated by a central area of irregular geometry that includes the Narrows. Lake current was measured at 3 depths from 2 moorings in the Narrows and was compared with water level records from 7 gauges around the lake throughout the ice free season (May 15-October 15, 1976). The dominant lake response was a forced response produced by natural fluctuations in the wind with periods of 50-100 hours. Large amplitude water level and current fluctuations were produced by low wind speeds due to resonance caused by wind periodicity near the 39 hour natural co-basin oscillation of the lake. Although damping is subcritical, allowing for a resonant response, Lake Winnipeg is heavily damped compared to deep lakes. The co-basin oscillation is so low in frequency that a classical wind setup is unlikely to occur. Free oscillations were of secondary importance to the large-scale dynamicsj of the lake. Several shole lake modes higher than the first were identified from the current and water level records, but the amplitudes of these modes were very small compared to the free response of the Great Lakes. There was also a detectable response in the records at several natural frequencies of the individual basins and at the M sub 2 tide. (Sims-ISWS)
W79-06755

LOW-FREQUENCY CURRENT FLUCTUATIONS IN LAKE ONTARIO, WINTER 1972-1973 (IFYGL),
Wisconsin Univ.-Milwaukee. Center for Great Lakes Studies.
G. O. Marmorino.
Journal of Geophysical Research, Vol. 84, No. C3, p 1206-1214, March 20, 1979. 11 fig, 2 tab, 21 ref. NOAA 04-6-022-44026.

Descriptors: *Great Lakes, *Lake Ontario, *Currents(Water), On-site investigations, On-site data collections, Data processing, Lakes, Winter, Winds, Fluctuations, Variability, Temperature, Water temperature, Circulation, Water circulation, Limnology.

An analysis was presented of thelow-frequency (omega less than 0.6 cycles per day) current fluctuations in Lake Ontario, using measurements made at 15 and 75 m during the 1972-1973 winter. The data, collected as part of the International Field Year for the Great Lakes (IFYGL), were obtained at 9 stations: 1 near midlake and the other 8 spaced around the lake, about 50 km apart and 12 km from shore. Let U denote the alongshore velocity (positive leaving the shore to the right) and V the cross-shore velocity (positive offshore). It was found that (1) the standard deviation of V is approximately constant; (2) the standard deviation of U, which is about 2.4 times greater than that of V, may be depth independent and is less at the southern shore stations than at the shallower northern stations where the flow appears to be directly wind driven; (3) the velocity fluctuations are roughly aligned with the local orientation of the coastline; (4) the U fluctuations show much better mutual correlation than the V fluctuations, having an alongshore coherence length of about 250 km (nearly half the basin perimeter); (5) the U signal shows high coherence for periods of about 10-25 and 4-5 days; and (6) the computation of lagged correlations shows the U fluctuations to propagate in a counterclockwise sense from the northern shore at a rate of about 42 km/d(0.5 m/s), which implies a period of about 13 days for a complete circuit around the lake. These results provided additional evidence for the existence of topographic Rossby waves (shelf waves) in Lake Ontario, the calculated period being consistent with results of previous studies which used data from the summer and fall of 1972. (Sims-ISWS)
W79-06756

ON THE NUMERICAL COMPUTATION OF TWO-LAYER NEARLY HORIZONTAL FLOWS,
Seaconsult Marine Research Ltd., Vancouver (British Columbia).
For primary bibliographic entry see Field 2E.
W79-06758

ICE GROWTH STUDIES IN DULUTH-SUPERIOR HARBOR 1974-75,
Minnesota Univ. -Duluth.
For primary bibliographic entry see Field 2C.
W79-06763

SUPERCRITICAL WITHDRAWAL FROM TWO-LAYERED FLUID SYSTEMS, PART 1: TWO-DIMENSIONAL SKIMMER WALL,
Cornell Univ., Ithaca, NY. Dept. of Environmental Engineering.
G. H. Jirka.
Journal of Hydraulic Research, Vol 17, No 1, p 43-51, 1979. 4 fig, 11 ref.

Descriptors: *Stratified flow, *Model studies, *Intakes, *Flow control, Mathematical models, Analytical techniques, Theoretical analysis, Analysis, Weirs, Laboratory tests, Supercritical flow, Hydraulic structures, Intakes structures, Reservoirs, *Skimmer wall, *Selective withdrawal, Two-dimensional flow, Two-layer flow.

An analysis of the selective withdrawal features of a two-dimensional skimmer wall was developed based on the concept of a double critical flow section in the two-layered stratified fluid system. The theory predicts the withdrawal ratio as a function of two governing parameters, a densimetric Froude number and a layer depth ratio. The skimmer wall design condition of incipient withdrawal as derived by Harleman and Elder (1965) is included as a special case. Good qualitative agreement with available experimental data is found. An 'effectiveness' diagram displaying the fully effective, partially effective and non-effective regimes of skimmer wall operation was developed. (See also W79-06767) (Humphreys-ISWS)
W79-06766

SUPERCRITICAL WITHDRAWAL FROM TWO-LAYERED FLUID SYSTEMS, PART 2: THREE-DIMENSIONAL FLOW INTO ROUND INTAKE,
Cornell Univ., Ithaca, NY. Dept. of Environmental Engineering.
G. H. Jirka, and D. S. Katavola.
Journal of Hydraulic Research, Vol 17, No 1, p 53-62, 1979. 8 fig, 1 tab, 5 ref.

Descriptors: *Stratified flow, *Intakes, *Flow control, *Model studies, Hydraulic structures, Intakes structures, Laboratory tests, Hydraulic models, Analytical techniques, Analysis, Dimensional analysis, Supercritical flow, Conduits, Reservoirs, *Round intake, *Selective withdrawal, Three-dimensional flow, Two-layer flow.

An experimental study was made of the selective withdrawal characteristics of a round horizontal axis pipe intake located in a vertical wall. The ambient fluid system has a two-layer stratification with a diffuse interface. The results for incipient withdrawal indicate considerably lower critical Froude numbers than that obtained by earlier studies by Craya (1949) and Gariel (1949). Geometry effects due to the intake diameter and the pycnocline thickness appear to cause this discrepancy. The supercritical withdrawal ratio from both fluid layers exhibits a unique dependence on the densimetric Froude number normalized by its critical

value. The withdrawal characteristics in the supercritical range, with simultaneous withdrawal from both layers, can be represented by a unique empirical curve independent of geometric effects. (See also W79-06766) (Humphreys-ISWS)
W79-06767

OPERATORS PRESENT TESTIMONY IN DEFENSE OF PLAYA LAKE DISPOSAL,
For primary bibliographic entry see Field 5C.
W79-06808

HYDROLOGY OF LAKES IN THE MINNEAPOLIS-SAINT PAUL METROPOLITAN AREA: A SUMMARY OF AVAILABLE DATA STORED--USING A DATA-BASE MANAGEMENT SYSTEM,
Geological Survey, St. Paul, MN. Water Resources Div.
M. S. McBride.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-292 413, Price codes: A14 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 76-85, September 1976. 317 p, 2 fig, 8 tab, 7 ref.

Descriptors: *Lakes, *Limnology, *Hydrology, *Lake morphometry, *Data storage and retrieval, Hydrologic data, Inflow, Discharge(Water), Water levels, Ecology, Geomorphology, Data processing, Urban hydrology, *Minneapolis-St Paul metropolitan area, *System 2000, Level B studies.

Data were collected and summarized on the hydrology and hydrogeology of 949 lakes, 10 acres or larger, in the Minneapolis-St. Paul metropolitan area, Minnesota. Eight tables totaling over 100 pages present data on location, depth, area, lake level, ecological and game-management classification, inflowing and outflowing streams, soils, bedrock type, water added to or taken from lake, and reported lake-related problems. SYSTEM 2000, a generalized computer data-base management system, was used to organize the data and prepare the tables. SYSTEM 2000 provides powerful capabilities for future retrieval and analysis of the data. The data base is available to potential users so that questions not implicitly anticipated in the preparation of the published tables can be answered readily, and the user can retrieve data in tabular or other forms to meet his particular needs. (Woodard-USGS)
W79-06815

DISSOLVED-SOLIDS BUDGET OF LAKE OKEECHOBEE, FLORIDA, OCTOBER 1964 TO SEPTEMBER 1974,
Geological Survey, Tallahassee, FL. Water Resources Div.
D. V. Maddy.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-293 028, Price codes: A03 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 77-97, 1978. 36 p, 3 fig, 14 tab, 22 ref.

Descriptors: *Hydrologic budget, *Dissolved solids, *Lakes, *Inflow, *Discharge(Water), Rainfall, Evaporation, Regression analysis, Water quality, Florida, *Lake Okeechobee.

Lake Okeechobee is a major surface-water storage facility for south Florida. A dissolved-solids budget for Lake Okeechobee was computed for Oct. 1964 to Sept. 1974, a 10-year budget period. Calculations were based on records of daily discharge, daily specific conductance measurements, and regression equations relating dissolved-solids concentrations and specific conductance. The lake received more than 13 million acre-feet of rainfall during the budget period and lost more than 18 million acre-feet of water to evaporation. Lake Okeechobee received more than 20 million acre-feet of inflow and released almost 16 million acre-feet to distributaries. A water budget of 34.48 million acre-feet for the 10-year budget period was computed. Rainfall produced an input of 460,000 tons of dissolved solids to Lake Okeechobee. Inflow from tributaries and distributaries added 5.51 million tons of dissolved solids to the lake and outflow to distributaries removed 6.71 million tons. A dissolved-solids budget of 6.99 million tons for the 10-year budget period was computed. (Woodard-USGS)
W79-06817

PRELIMINARY WATER-QUALITY CHARACTERIZATION OF LAKES IN WASHINGTON,
Geological Survey, Tacoma, WA. Water Resources Div.
G. C. Bortleson.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-291 100, Price codes: A03 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 77-94, 1978. 31 p, 5 tab, 25 ref. append.

Descriptors: *Washington, *Lakes, *Chemical properties, *Physical properties, *Analytical techniques, Water analysis, Chlorophyll, Evaluation, Planning, Lake restoration.

A method is described for comparing and characterizing lakes in Washington on the basis of water quality. The method can aid in selecting lakes for lake-restoration efforts. To simplify comparisons, a characteristic value (CV) was developed for each of 617 lakes in Washington using principal-component analysis. Three of 14 water-quality properties measured were used in this analysis because the principal component of the three properties accounted for 63 percent of the variance in the correlation matrix. The three properties were Secchi-disc visibility and concentrations of phosphorus and organic nitrogen. The significance of the derived CV's was evaluated by regression of chlorophyll a concentration against CV. The resulting standard error of estimate of + or - 1.8 micrograms per liter of chlorophyll a indicated that the CV can be a useful index in assessing relative water-quality and trophic conditions among lakes. (Woodard-USGS)
W79-06824

SEASONAL SUCCESSION OF PHYTOPLANKTON IN ROOSEVELT LAKE, ARIZONA,
Arizona State Univ., Tempe. Dept. of Botany and Microbiology.
R. Cisneros, R. D. Olsen, and M. R. Sommerfeld.
Journal of the Arizona-Nevada Academy of Science, Vol. 14, No. 1, p 7-12, Feb. 1979, 2 fig, 1 tab, 26 ref.

Descriptors: *Phytoplankton, *Marine algae, *Succession, *Biological communities, *Lake morphometry, *Seasonal, Aquatic life, Diatoms, Euphotic zone, Chlorophyta, Cyanophyta, Algae, Aquatic algae, Arizona, Roosevelt Lake.

Although there have been several recent investigations on the phytoplankton of Arizona lakes, data on the abundance of phytoplankton and their seasonal dynamics in southwestern lakes remain relatively sparse. The present study was performed to determine the composition and seasonal pattern of phytoplankton succession in Roosevelt Lake, 126 km ENE of Phoenix in Gila County, Arizona, from February 1971 through August 1974. Four sampling sites were established to represent differences in reservoir morphometry, and phytoplankton were collected from the surface 2, 5, 10 and 20 M although the data presented here is primarily from the 2 M samples collected from February 1971 through February 1972. Site selections, depths and time periods were chosen to be generally representative of species richness, abundance and succession in the euphotic zone of Roosevelt Lake. Results indicated that 109 species of algae occurred annually in the plankton of this lake, the majority of which were the species Chlorophycean and Bacillariophycean. Community size was found to be relatively constant throughout the year although a noticeable succession of algal classes and species occurred in which blue green algae was summer dominant and diatoms dominated the winter flora. Algal flora was found to be primarily temperate in nature with some tropical tendencies. (Tickes-Arizona)
W79-06845

A GENERAL CIRCULATION MODEL FOR LAKES,
National Oceanic and Atmospheric Administration, Ann Arbor, MI. Great Lakes Environmental Research Lab.
J. C. K. Huang.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-281 834, Price codes: A03 in paper copy, A01 in microfiche. Report No. NOAA Technical Memorandum ERL GLERL-16, August 1977. 46 p, 12 fig, 1 tab, 30 ref, 1 append.

Descriptors: *Lakes, *Model studies, *Circulation, *Equations, *Water circulation, *Lake morphology, Lake morphometry, Bathymetry, Surface waters, Wind pressure, Meteorology, Currents(Water), Density currents, Movement, Lake breezes, Lake Ontario, Research and development, Thermocline, Boundary layers, Air-water interfaces, Water temperature.

The lake circulation model developed is based on primitive equations relative to a geographic coordinate system on the surface of the earth, and takes all major physical processes into account, including the nonlinear effects and the horizontal effects, with a rigid lip approximation for computational efficiency. It simulates the organized water motion and temperature structure throughout the annual cycle to enable the physical nature of the lake to be understood in response to atmospheric forcing. Fresh water density is approximated as a quadratic function of temperature. Imposed meteorological conditions drive lake circulation. Test runs were made using the geometry and bathymetry of Lake Ontario on a 5-km grid with four vertical layers. Two cases where surface winds and heat are similar to the average conditions of July and November show that the total lake response is dominantly barotropic and gradually become baroclinic. Wind pattern, surface current, and flow pattern data are discussed. That the simulated current pattern did not totally agree with the International Field Year for the Great Lakes data may be due to the coarse grid separations in the horizontal and vertical directions without proper resolution of the boundary layers and the thermocline. It is expected that the errors involved with stresses and heating will be reduced when time-dependent, seasonal variation runs are made. (Davison-IPA)
W79-06871

PROCEEDINGS: LAKE MANAGEMENT CONFERENCE, JUNE 9, 1977, UNIVERSITY OF CONNECTICUT, STORRS.
Connecticut Univ., Storrs. Inst. of Water Resources.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-296 093, Price codes: A07 in paper copy, A01 in microfiche. Report No. 30, March 1979. 130 p, 28 fig, 19 tab, 48 ref. OWRT A-999-CONN(18). OWRT 14-34-0001-9007.

Descriptors: *Lakes, *Eutrophication, Phosphorus, Land use, Groundwater, Lake management, Connecticut lakes, Nutrient budgets.

Eight technical papers on various aspects of lake management were presented at the Lake Management Conference held at the University of Connecticut in 1977. The results of research on the various suspected causes of lake eutrophication, the relationship of land use to lake water quality, the ongoing lake management strategies and the plans suggested for future approaches were explained. The effectiveness of various eutrophication control methods were discussed and the costs to be expected for the use of these methods were given. Emphasis was placed on the management of Connecticut lakes, although studies on lakes throughout the state and the nation were also mentioned. Two major benefits of the conference were the presenting of new technical information on lake management strategies by the speakers and the opportunity of participants to meet people who have some of the information and background in managing lakes. (de Lara-Conn)
W79-06893

ESTIMATION OF WATER SURFACE ELEVATION PROBABILITIES AND ASSOCIATED DAMAGES FOR THE GREAT SALT LAKE,
Utah Water Research Lab., Logan.
L. D. James, D. S. Bowles, W. R. James, and R. V. Canfield.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-296 056, Price codes: A09 in paper copy, A01 in microfiche. Water Resources Planning Series UWRL/P-79/03, March 1979. 182 p, 6 append, 25 fig, 63 tab. OWRT B-153-UTAH(2). 14-34-0001-8122.

Descriptors: Flood estimate, Frequency analysis, *Lake stages, Stochastic models, Synthetic hydrology, Lakes, *Water levels, Great Salt Lake, Terminal lakes.

Rising water surface elevations in perennial terminal lakes threaten major damages to shoreline industrial plants, transportation routes, and wetlands. Falling elevations increase pumping costs for industries extracting minerals from the lake water and reduce the quality of shoreline recreation. The managers of these properties need information on future lake level probabilities for planning, and public agencies need information on both probabilities and damages to determine whether lake level control is justified. Methods of operational hydrology were used to simulate lake level and shoreline damage sequences for the Great Salt Lake. Both ARMA (1,0) and ARMA (1,1) models were tried in generating multivariate sequences of precipitation, evaporation, and three river flows for 1937-1977. The multivariate Markov model was the only one able to preserve historical sequences, but recommendations for improved parameter solution techniques for the ARMA (1,1) model are made to help future users take better advantage of its theoretically greater ability to preserve hydrologic persistence. The model developed with the capability of estimating low future lake level probabilities would be affected by upstream water development and by pumping water from the lake during high stages into the western desert. Data on damages to 21 cost centers were collected, and a damage simulation model was developed to use them to estimate average annual damages under current conditions and benefits from lake level control efforts. Average annual damages to the mineral industry, railroads, highways, wetlands, and other properties were estimated to be currently $1,550,000.
W79-06894

ON PRESSURE-WORK, VISCOUS DISSIPATION AND THE ENERGY BALANCE RELATION FOR GEOTHERMAL RESERVOIRS,
Systems, Science and Software, La Jolla, CA.
S. K. Garg, and J. W. Pritchett.
Advances in Water Resources, Vol. 1, No. 1, p 41-47, September 1977. 2 tab, 11 ref.

Descriptors: *Geothermal studies, *Reservoirs, *Pressure-work, *Viscous dissipation, *Energy, *Balance laws, Flow, Effects, Temperature, Computers, Simulation analysis, Equations, Numerical solutions, Mass, Momentum.

This article examines the conditions under which the pressure-work and viscous dissipation terms should be retained in the energy balance relation for single (liquid water or vapor) and two-phase (liquid water and vapor) fluid flow through porous media. It is shown that if one wishes to retain the pressure-work term, then one must also keep the viscous dissipation term in the energy balance. Consideration of steady non-isothermal radial flow demonstrates that both pressure-work and viscous dissipation are liable to have negligibly small effects in single phase liquid water and in two-phase liquid-vapor systems. This conclusion is, however, not generally valid for pure vapor systems; in this case, pressure-work and viscous dissipation can produce significant variations in the computed reservoir response. (Bell Graf-Cornell)
W79-06924

OPERATIONAL EFFECTS OF IRRIGATION AND PUMPED STORAGE ON THE ECOLOGY OF BANKS LAKE, WASHINGTON,
Washington Univ., Seattle. Fisheries Research Inst.
Q. J. Stober, R. W. Tyler, J. A. Knutzen, D. Gaudet, and C. E. Petrosky.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-293 790, Price codes: A08 in paper copy, A01 in microfiche. Final Report No. REC-ERC-77-5, December 1977. 165 p, 100 fig, 27 tab, 71 ref, 1 append. 14-06-100-7794.

Descriptors: *Ecology, *Fish, *Fish populations, *Fish management, *Pumped storage, *Limnology, *Powerplants, Drawdown, Environmental effects, Lake morphology, Nutrients, Reservoirs, Fish reproduction, Sport fish, Phytoplankton, Zooplankton, Columbia Basin Project, Banks Lake, Franklin D. Roosevelt Lake(Washington).

The physical, chemical and biological changes in Banks Lake, Washington, resulting from pumping/generating operations are discussed. Banks Lake functions as the reregulating reservoir for the Columbia Basin irrigation project. Results of the following studies are reported: limnology of the lake, fish populations monitoring, kokanee fry study, 1975-76 sport fishery, and fish entrainment through the irrigation and feeder canals. The north pool of this two pool system is directly influenced by the pumped input of water from FDR Reservoir. This pumped inflow maintained warmer temperatures in the winter and cooler temperatures in the summer in the north pool relative to the south pool. The north pool showed thorough mixing of the water column, greater concentrations of the plant nutrients, nitrates and phosphates, and greater phytoplankton production than found in the south pool. Zooplankton developed in the south pool. Of the 22 species of fish identified in the lake 90% were yellow perch, lake whitefish, and kokanee. In general the three major species avoided the north pool. Drawdown of the lake in 1973 and 1974 resulting from powerplant construction at Grand Coulee Dam reduced the reproduction of the yellow perch and kokanee. Fish loss due to entrainment occurred mainly through the irrigation canal; fish entrainment through the feeder canal was relatively minor. It is concluded that nutrient addition and mixing are beneficial, but water level fluctuations, entrainment and flushing limit production and maintenance of aquatic life. (Davison-IPA)
W79-06942

2I. Water In Plants

SEASONAL WATER USE BY WINTER WHEAT GROWN UNDER SHALLOW WATER TABLE CONDITIONS,
Govind Ballabh Pant Univ. of Agriculture and Technology, Pantnagar (India).
For primary bibliographic entry see Field 2G.
W79-06691

LEAF OSMOTIC POTENTIAL AS AN INDICATOR OF CROP WATER DEFICIT AND IRRIGATION NEED IN RAPESEED (BRASSICA NAPUS L.),
Department of Agriculture, Swift Current (Saskatchewan). Research Station.
J. M. Clarke, and G. M. Simpson.
Agricultural Water Management, Vol 1, No 4, p 351-356, December, 1978. 2 fig, 3 tab, 8 ref.

Descriptors: Moisture deficit, *Moisture content, Water requirements, Moisture stress, Moisture tension, Leaves, Tensiometers, *Osmotic pressure, Crop production.

Leaf osmotic potentials (LOP) of field-grown rapeseed (Brassica napus L.) were measured in 1975 and 1976 under rainfed conditions and at two levels of irrigation. Irrigations were scheduled on the basis of tensiometer measurements in 1975, and on the basis of LOP in 1976. The LOP of rainfed plants was lower (more negative) than that of irrigated plants. Leaf osmotic potential responded to changes in soil moisture caused by precipitation or irrigation. Tensiometers placed at 0.2 m depth in the high irrigation treatment were as responsive to soil moisture changes as LOP. Scheduling of irrigations on the basis of LOP in 1976 produced yield differences between water regimes similar to those obtained in 1975. It was concluded that leaf osmotic potential provides a satisfactory means for determining need for irrigation in B. napus. (Skogerboe-Colorado State)
W79-06708

SOYBEAN CROP WATER REQUIREMENTS,
Regional Center of Agricultural Research, Crida (Spain). Dept. of Cereals and Legumes.
J. Dominquez, M. Horta, and E. Robledo.
ICID Bulletin (International Commission on Irrigation and Drainage), Vol. 27, No. 2, p 30-35, July, 1978. 3 fig, 22 ref.

Descriptors: Soil-water-plant relationships, *Water requirements, *Soybeans, Moisture deficit, Moisture stress, Growth stages, Evapotranspiration, Yield equations, Crop production.

In experiments carried out in the three-year period 1974-1976, in 'Finca El Encin', CRIDA, Alcala de Henares, on soybean crops irrigated by sprinklers, Amsoy variety, a very high correlation between the RET (Real Evapotranspiration) in the flowering and pod formation period and the final grain production was found. This suggested, on the one hand, subjecting the plant to an initial deficit to adequately develop the root system and on the other, supplying quantities of about 9 mm during The said period, which should increase the production level to 4,000 kg/hectare. Penman's modified formula for daily application, following the guidelines of the Irrigation Management Service, proved to be inadequate in the sense that it provided low ETP values. A greater consideration of the aerodynamic term was suggested by the influence that the advective effect has on irrigation areas with arid climate. For practical experiments the scheme based on the utilization of the distribution curves of a water sprinkler, was satisfactory, leading to a more reliable analysis, and to a simplification of the experimental procedure. (Skogerboe-Colorado State)
W79-06712

WATER BALANCE OF FLOODED RICE PADDIES,
Texas A and M Univ., College Station. Dept. of Soil and Crop Sciences.
K. W. Brown, F. T. Turner, J. C. Thomas, L. E. Deuel, and M. E. Keener.
Agricultural Water Management, Vol. 1, No. 3, p 277-291, November, 1978. 10 fig, 3 tab, 8 ref.

Descriptors: *Water balance, Submerged plants, *Flood irrigation, *Rice, Evapotranspiration, Runoff.

Rice (Oryza sativa L., var. Labelle) was grown in 300 m 2 paddies of Beaumont clay soil (Typic pelludert) and subjected to two management schemes of flooded rice culture. These schemes were continuous irrigation and intermittent irrigation. Careful measurements of irrigation, precipitation, evapotranspiration, deep percolation and runoff were made, and the total water balance for the two water management schemes was calculated. The results showed continuous irrigation to be very wasteful of water with slightly over 1 m of irrigation water applied to supply an evapotranspirational need of 0.5-0.6 m. The intermittent irrigation management was less wasteful but still could be improved upon. Suggestions were presented for techniques to help improve the water use efficiency and reduce runoff losses. (Skogerboe-Colorado State)
W79-06713

GRAPEFRUIT RESPONSE TO VARIABLE SALINITY IN IRRIGATION WATER AND SOIL,
Agricultural Research Organization, Bet-Dagan (Israel). Inst. of Soils and Water.
H. Bielorai, J. Shalhevet, and Y. Levy.
Irrigation Science, Vol. 1, p 61-70, 1978, 3 fig, 4 tab, 16 ref.

Descriptors: *Grapefruit, *Saline water, *Crop response, *Irrigation water, *Soil-water-plant relationships, Water quality, Soil chemical properties, Salt tolerance, Irrigation effects, Consumptive use, Citrus fruits, Israel.

Increasing salinity in irrigation water throughout the arid-semiarid world is a matter of growing concern in regions where irrigated crops such as citrus are vital to export economies. The field experiment described in this paper was conducted in the northern Negev Desert region of Israel during 1973-1976 where a control orchard was subjected to 8 varying concentrations of sodium chloride and calcium chloride injected into the sprinkler irrigation system. Soil water content was measured before and after each irrigation at intervals .3m to a depth of 1.8m with a neutron probe. Irrigation efficiency for each irrigation was determined by the difference between pre-and post-irrigation soil water content. Results indicate that total water uptake was reduced as salt concentration in the soil increased, and yield was linearly related to the mean chloride concentration in the soil saturation extract. Salt accumulation in the soil was found to be dependent on the quantity and salt concentration of the irrigation water, rainfall, and the amount of leaching. No leaf injury was observed. It is concluded that the effect of salinity on grapefruit yield is osmotic rather than the result of a specific ion. (Tickes-Arizona)
W79-06841

SEASONAL SUCCESSION OF PHYTOPLANKTON IN ROOSEVELT LAKE, ARIZONA,
Arizona State Univ., Tempe. Dept. of Botany and Microbiology.
For primary bibliographic entry see Field 2H.
W79-06845

CORN PRODUCTION AS INFLUENCED BY IRRIGATION AND SALINITY - UTAH STUDIES,
Utah State Univ., Logan. Dept. of Soil Science and Biometeorology.
R. J. Hanks, G. L. Ashcroft, V. P. Rasmussen, and G. D. Wilson.
Irrigation Science, Vol. 1, p 47-59, 1978. 9 fig, 3 tab, 8 ref. OWRT B-121-UTAH(3) and C-5189(4233)(4).

Descriptors: *Crop response, *Salty tolerance, *Corn, *Irrigation effects, *Soil-water-plant relationships, *Evapotranspiration, Consumptive use, Plant growth, Saline water, Saline soil, Water quality, Sprinkler irrigation.

Described here are the Utah results of a wider study carried out in Arizona, California, Colorado, and Utah, 1974-1975, to develop a predictive model of the several site-specific irrigation and salinity effects on corn production. Trials conducted at Utah State University's Greenville Farm on silt loam soil evaluated the influence of differing amounts and timing of saline irrigation water. Using trickle irrigation, treatments were applied uniformly at all water levels. Results indicated that corn grain and total dry matter production were linearly related to evapotranspiration, regardless of the irrigation or salinity regimes. Soil pre-salinization decreased yields in proportion to the salinity imposed. The decrease was associated with reductions in evapotranspiration caused by reduced soil water depletion, as compared with the non-salinized treatments. (Tickes-Arizona)
W79-06860

2J. Erosion and Sedimentation

SEDIMENT SIZES ERODED FROM ROW-CROP SIDESLOPES,
Science and Education Administration, Oxford, MS. Sedimentation Lab.
L. D. Meyer, W. C. Harmon, and L. L. McDowell.
Paper No 78-2518, Presented at the 1978 Winter Meeting of the American Society of Agricultural Engineers, December 18-20, 1978 Chicago, Illinois. 9 p. 7 fig, 4 tab, 13 ref. ASAE, St. Joseph, Michigan.

Descriptors: Sediments, *Sediment distribution, Simulated rainfall, *Soil erosion, Rainfall intensity, Canopy.

Row sideslopes of ten soils were studied under simulated rainstorms to determine the size distributions of their eroded (undispersed) sediment. The eroded sediment sizes for different soils differed considerably. These distributions were compared to the size distributions of the dispersed sediment and original surface soil. The undispersed sediment was coarser than the dispersed soil or sediment, much coarser for many soils. For each soil, the sediment size distribution changed relatively little with major changes in rain intensity, continued erosion, and crop canopy. (Skogerboe-Colorado State)
W79-06547

EVALUATION OF GRASS CHARACTERISTICS RELATED TO SEDIMENT FILTRATION,
Kentucky Univ., Lexington. Dept. of Agricultural Engineering.
J. C. Hayes, B. J. Barfield, and R. I. Barnhisel.
Paper No. 78-2513, Presented at the 1978 Winter Meeting of the American Society of Agricultural Engineers, December 18-20, 1978, Chicago, Illinois. 21 p, 7 fig, 2 tab, 10 ref. ASAE, St. Joseph, Michigan.

Descriptors: *Sediment transport, Sediment control, Filtration, *Grasses, Vegetation effects, Sediment yield, Regression analysis, Roughness coefficient, Watershed management.

Vegetal filtration was proposed as a means of reducing sediment from disturbed areas. Recent studies using simulated media have led to relationships which define deposition within a grass filter. Several characteristic dimensions were required to define the effects of vegetation on flow and sediment transport. Quantification of these dimensions, sensitivity of the relations to errors in measurement, and further verification data were included. (Skogerboe-Colorado State)
W79-06549

FARM LEVEL ECONOMIC EVALUATION OF EROSION CONTROL,
Iowa State Univ., Ames.
J. M. McGrann.
Paper No. 78-2515, Presented at the 1978 Winter Meeting of the American Society of Agricultural Engineers, December 18-20, 1978, Chicago, Illinois. 13 p. 2 fig, 3 tab, 15 ref. ASAE, St. Joseph, Michigan.

Descriptors: *Erosion control, Soil erosion, Cost comparisons, Soil management, Economic impact, *Contour farming.

Farm level economic evaluation of erosion control alternatives in three major soil associations in Iowa indicated that: (1) residue tillage and contouring is the most cost effective alternative to reduce soil erosion, (2) the economic impact of reducing soil loss is less on mixed crop and livestock farms than specialized crop farms, and (3) although the economic impact of erosion control differs between soil areas, reduction of soil loss below the 5 ton level can be accomplished through conservation tillage in large areas of Iowa with little reduction in farm income without public participation in farm level costs. (Skogerboe-Colorado State)
W79-06550

EROSION INVENTORY-SHEET AND RILL EROSION,
Soil Conservation Service, Washington, DC.
R. I. Dideriksen, and A. R. Hidlebaugh.
Paper No. 78-2514, Presented at the 1978 Winter Meeting of the American Society of Agricultural Engineers, December 18-20, 1978, Chicago, Illinois. 33 p, 3 fig, 14 tab, 13 ref. ASAE, St. Joseph, Michigan.

Descriptors: *Soil erosion, *Rill erosion, Sheet erosion, Wind erosion, Erosion control, Data collections, Conservation.

Erosion by wind and water from farmland remains a serious problem in the United States. This inventory takes a new look at the problem and provides current information on natural and related resources on nonfederal land for all states except Alaska. Nearly one quarter million randomly selected sample sites were observed in the field and farm owners and operators were interviewed. The data gathered in 1977 were used in the Universal Soil Loss and Wind Erosion models to estimate the rate and amount of sheet, rill, and wind erosion for different soils, land uses, and management systems. (Skogerboe-Colorado State)
W79-06551

NITROGEN AND PHOSPHORUS LOSSES IN RUNOFF FROM NO-TILL SOYBEANS,
Science and Education Administration, Oxford, MS. Sedimentation Lab.
For primary bibliographic entry see Field 5G.
W79-06552

CHEMICAL LOADINGS TO SOUTHWESTERN LAKE SUPERIOR FROM RED CLAY EROSION AND RESUSPENSION,
Wisconsin Univ.-Superior. Dept. of Chemistry.
For primary bibliographic entry see Field 2H.
W79-06599

INVESTIGATION OF THE PROBABILISTIC REGULARITIES OF SALTATION OF SOLID PARTICLES IN A TURBULENT FLOW,
Akademiya Nauk SSSR, Moscow. Inst. Vodnykh Problem.
N. N. Grishin.
Water Resources, Vol. 4, No. 6, p 941-947, November-December 1977. 4 fig, 20 ref. Translated from Vodnye Resursy, No. 6, p 174-181, November-December 1977.

Descriptors: *Saltation, *Sediment transport, *Suspended solids, *Sediments, *Model studies, Mathematical models, Erosion, Turbulent flow, Velocity, Turbidity, Movement, Sedimentology.

The movement of solid particles in turbulent air or water flows has, as a rule, a leap-like character. The existing theories of the bounding movement of sediments are usually based on the assumption of the absence of interaction between particles, i.e., the content of sediments in a unit volume of the medium transporting them is assumed to be sufficiently small. However, in many problems the need arises to examine the mass movement of sediments. The particles saltating near the bottom form turbidity there; the magnitude of the near-bottom turbidity is usually taken as a boundary condition of the diffusion equation, by means of which the distribution of suspended sediments in open flows for not very large concentrations and sufficiently small sizes of the particles is generally described. In connection with this, it is of interest to study the problem of the permissible concentrations of saltating particles for which the regularities obtained for the case of movement of single particles are still valid. Examining the mass movement of particles, we must take into account both the collision of particles and their effect on kinematics of the flow. In this article, the kinematics of the particles themselves, the average velocity relative to their movement, were examined. By means of this examination the probability of collision of the particles was estimated. Therefore, the values of the concentrations of saltating sediments corresponding to the upper limit of applicability of the aforementioned concept of noninteraction between particles can be obtained. (Sims-ISWS)
W79-06610

FLOW PAST BODIES IN A TURBULENT FLOW NEAR A SOLID SURFACE,
Akademiya Nauk SSSR, Moscow. Inst. Vodnykh Problem.
K. I. Rossinskii, and K. M. Arbulieva.

Water Resources, Vol. 4, No. 6, p 926-935, November-December 1977. 9 fig, 10 ref. Translated from Vodnye Resursy, No. 6, p 156-167, November-December 1977.

Descriptors: *Turbulent flow, *Boundary layers, *Bottom sediments, Suspended solids, Model studies, Mathematical models, Flow, Hydraulics, Reynolds number, Boundaries(Surfaces), Fluid mechanics, Sedimentation, Erosion, Sedimentology, Flow past bodies.

If a turbulent flow is underlain by soil consisting of individual particles not cohering to one another, then at sufficient current velocities of the water individual soil particles are detached from the bottom by the flow and either perform leaps near the bottom or are entrained into the flow and move in a suspended state. Detachment of the particles occurs as a result of the hydrodynamic action of the flow. The nature of this action is still the subject of debate. During interaction of a moving fluid and a solid body located in it which has a symmetrical form relative to the direction of the average current (sphere, cylinder with an axis normal to the current, etc.) in an unconfined flow, as is known, does not occur, since the pressures developing on the upper and lower surfaces of such a body are the same on both sides and cause only tensile stresses within the body. The effect of a wall on the force developing during flow past a body has been studied by a number of investigators and at present interesting data have been accumulated which permit judging the character of the phenomenon. The results of such investigations were presented, and one of the possible explanations of the nature of the lift detaching solid particles from the bed of a turbulent flow was given. (Sims-ISWS)
W79-06612

INPUT-OUTPUT MODEL FOR RUNOFF-SEDIMENT YIELD PROCESSES,
Govind Ballabh Pant Univ. of Agriculture and Technology, Pantnagar (India). Dept. of Agricultural Engineering.
T. C. Sharma, W. G. S. Hines, and W. T. Dickinson.
Journal of Hydrology, Vol. 40, No. 3/4, p 299-322, February 1979. 6 fig, 12 tab, 13 ref.

Descriptors: *Sediment yield, *Model studies, *Runoff, Watersheds(Basins), Statistical methods, Statistical models, Hydrology, Equations, Mathematical models, Stochastic processes, Analysis, Monthly, *Watershed fluvial system, Parsimonious models, Input-output models.

Runoff (log-transformed) and sediment yield (log-transformed) sequences on a monthly or daily basis can be regarded as input and output for the watershed fluvial system. These sequences are nonstationary, in general, in different hydrological environments. Frequency and time domain analyses have shown that a parsimonious model can be built directly in terms of these nonstationary input-output sequences on a monthly and daily basis. A first-order dynamic model was found adequate to model the monthly runoff-sediment yield process; a second-order model adequately modeled the daily runoff-sediment yield process. The noise component in both cases possessed the characteristics of a white-noise sequence. (Lee-ISWS)
W79-06617

ESTIMATING SEDIMENT TRANSPORT IN A BRAIDED GRAVEL CHANNEL--THE KAWERONG RIVER, BOUGAINVILLE, PAPUA NEW GUINEA,
Papua and New Guinea Univ., Port Moresby (New Guinea).
G. Pickup, and R. J. Higgins.
Journal of Hydrology, Vol. 40, No. 3/4, p 283-297, February 1979. 8 fig, 1 tab, 17 ref.

Descriptors: *Sediment transport, *Channels, *Braiding, Monte Carlo method, Sedimentation, Sediments, Streams, Hydraulics, Equations, Rivers, *White River, *Papua New Guinea, *Bougainville Island(Papua New Guinea), *Braided channel, *Kawerong River(Papua New Guinea), Braided streams.

It is difficult to estimate sediment transport in braided rivers because of the complex hydraulics of rapidly changing multi-channel systems. This paper described an algorithm for generating sets of braided-river hydraulic parameters for use with sediment transport equations. The algorithm used random number-based simulation techniques and empirically determined probability distributions of individual hydraulic variables from the White River (U.S.A.) and the Kawerong River. A test of the suitability of the algorithm for the estimation of sediment transport was carried out over a period of two years using the Meyer-Peter and Muller equation on 8 reaches of the Kawerong River in which sediment transport is known. The test produced a mean absolute error of 16.3%, suggesting that the algorithm may have some potential in braided-river modelling. (Lee-ISWS)
W79-06618

THE INTRUSION OF FINE SEDIMENTS INTO A STABLE GRAVEL BED,
Oregon State Univ., Corvallis. School of Forestry.
R. L. Beschta, and W. L. Jackson.
Journal of the Fisheries Research Board of Canada, Vol. 36, No. 2, p 204-210, February 1979. 5 fig, 1 tab, 18 ref.

Descriptors: *Streambeds, *Laboratory tests, *Hydraulic models, *Sedimentation, Sediment transport, River beds, Gravels, Silting, Deposition(Sediments), Model studies, Sands, Bed load, Particle size, Hydraulics, Flow, Data collections, Methodology, Flow characteristics, Movement, Analysis, Riffles, Substrates.

A rectangular flume was used to study variables affecting the intrusion of fine sands into a stable gravel streambed. The amount of intrusion by sand (median particle diameter 0.5 mm) was determined under varied conditions of discharge, depth, velocity, flume slope, and rates of sediment transport. During all experimental tests, sand particles were trapped in voids within the upper 10 cm of an initially clean gravel bed (median particle diameter 15 mm), forming a barrier to further intrusion. An analysis of flow variables showed that flow conditions, as indexed by Froude number, significantly (90% confidence level) affected intrusion amounts, possibly by influencing the rate and depth of formation of the sand seal. Intrusion amounts, expressed as a percent of total volume, varied from 2 to 8%. Two replications used a finer grade sand (median particle diameter 0.2 mm) that intruded more and, in one case, completely filled the gravel pore space (25% by volume), further indicating that particle size, and not hydraulic variables, may have a more important influence on the total amount of intrusion. (Humphreys-ISWS)
W79-06643

KAOLINITE RESUSPENSION PROPERTIES,
Florida Univ., Gainesville. Dept. of Coastal and Oceanographic Engineering.
A. J. Mehta, and E. Partheniades.
Journal of the Hydraulics Division, American Society of Civil Engineers, Vol. 105, No. HY4, Technical Note, p 411-416, April 1979. 5 fig, 5 ref. NSF GK-31259.

Descriptors: *Erosion, *Cohesive soils, *Deposition(Sediments), *Laboratory tests, Movement, Suspended solids, Sediment transport, Sedimentation rates, Suspension, Tractive forces, Kaolinite, Incipient motion, Resuspension.

The phenomena of erosion and deposition of fine, flocculated, cohesive sediments were studied during the past several years. The first investigations, which were limited primarily to The erosion phase, were conducted in an open flume with recirculating water at ocean salinity with natural silty-clay sediments. Basic investigations of the depositional aspects of flocculated cohesive sediments were carried out more recently in an annular channel 60 inches in mean diameter, 8 inches wide, and 18 inches deep containing the water-sediment suspension, and an annular ring positioned within the channel and in contact with the water surface. A limited investigation of the resuspension properties of flow deposited sediment was carried out with a commercially available kaolinite in this apparatus. Limited experiments on the initiation of motion of sand grains in the annular channel-ring system showed a reasonable agreement with Shields' curve for incipient motion. The resuspension rates of stratified beds continuously decrease, and may even become zero, as the depth of erosion increases. On the other hand, the erosion rates of uniform beds remain constant. This is in agreement with earlier observations on natural bay deposits. The nondimensional plot of the erosion rate against the bed shear stress for uniform beds agrees with earlier results based on soils with drastically different mineralogical composition. (See also W75-05230, W76-04684, and W78-00078) (Humphreys-ISWS)
W79-06653

EROSION DEPOSITS IN TILE-DRAINS,
Macaulay Inst. for Soil Research, Aberdeen (Scotland).
E. Paterson, and B. D. Mitchell.
Agricultural Water Management, Vol. 1, No. 4, p 311-317, December, 1978. 2 fig, 1 tab, 6 ref.

Descriptors: *Tile drains, Tile drainage, Silting, Deposition(Sediments), *Soil erosion, Sedimentation.

The mechanism of silting up of tile field drains in two heavy textured surface water gley soils was examined by comparing the physical and mineralogical characteristics of deposits in drains with those of the clay soil directly above. The deposits consisted of clay, silt and sand and are distinctly laminated. They appeared to be the result of internal erosion of the soil. The processes operative seemed to have been: (a) inflow of soil through the drain joints; (b) sedimentation in the drain; (c) elution of very fine material. The possibility that this silting-up phenomenon is not uncommon in the tile field drains of surface water gley soils of Scotland was recognized. (Skogerboe-Colorado State)
W79-06694

EFFECT OF CHISEL VERSUS MOLDBOARD FLOWING ON SOIL EROSION BY WATER,
Science and Education Administration, Lafayette, IN. Soil, Water and Air Sciences.
For primary bibliographic entry see Field 4D.
W79-06695

INVESTIGATION OF THE SPEED OF BED LOAD MOVEMENT,
V. V. Romanovskiy.
Soviet Hydrology: Selected Papers, Vol. 16, No. 2, p 108-112, 1977. 2 fig, 10 ref, 1 append. Translated from Transactions of the State Hydrologic Institute (Trudy GGI), No. 242, p 71-81, 1977.

Descriptors: *Bed load, *Laboratory tests, *Theoretical analysis, *Sediment transport, Saltation, Foreign research, Sediments, Movement, Open channels, Analytical techniques, Methodology, Velocity, Traction, Roughness(Hydraulic), Hydraulics, *USSR.

To establish the relation between the speed of traction particles and their shape and flow velocity and to determine the lag of particles moving at the bottom behind their surrounding water mass, a theoretical study of the equation of motion of particles along the bottom and a laboratory investigation were described. The speed of bed load particles was determined experimentally in a small flume (7 m long and 0.2 m wide) and also in a large flume (0.5 m wide and 30 m long). The experiments were made with particles from 1.3 to 5.0 cm in diameter. The roughness of the flume bottom was uniform with projections of 0.02 cm, 0.15 cm, and 1 cm. The grains of the underlying surface were glued to the bottom of the flume. The results of the measurements were used to construct curves of the relation between the speed of particle traction and flow velocity. It was found that there is a

fairly close linear relationship between them, which is independent of the grain size of the underlying surface of the bottom. The tangent of the angle of slope of this straight line varies from 1.1 for spherical particles to 1.4 for flat particles. Analysis of the experimental data showed the following: (1) The speed of particles along the bottom (in the investigated range of relative coarseness 1.6 to 250) depends on the velocity of the streamline flow and is independent of the size of the projections (dimensions) of bottom roughness. (2) The lag of a particle behind the surrounding flow is a function of its initial traction speed and of its shape. (3) The lag of a particle behind its surrounding flow decreases with increasing flow velocity. (Humphreys-ISWS)
W79-06751

PRESENT AND POTENTIAL SEDIMENT YIELDS IN THE YAMPA RIVER BASIN, COLORADO AND WYOMING,
Geological Survey, Lakewood, CO. Water Resources Div.
E. D. Andrews.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-292 677, Price codes: A03 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 78-105, December 1978. 33 p, 10 fig, 4 tab, 32 ref.

Descriptors: *Sediment transport, *Sediment yield, *Sediment load, *Streamflow, *Flow duration, Hydrographs, Curves, Land use, Coal mines, Topography, Geology, River basins, Planning, Sediment control, *Yampa River basin(Colo-Wyo).

Average annual suspended- and total-sediment loads in streamflow were determined by the flow-duration sediment-transport-curve method at 18 sites in the Yampa River basin, Colorado and Wyoming. These computations indicate that about 2.0 million tons of sediment are carried by the Yampa River at Deerlodge Park during an average year. Significant areal differences in the sediment yield from various parts of the basin also were determined. The lower Little Snake River subbasin contributes about 60 percent of the total basin sediment yield, although it represents less than 35 percent of the area and supplies less than 3 percent of the streamflow. In contrast, the upland (eastern) one-third of the basin contributes only about 14 percent of the sediment yield but 76 percent of the streamflow. Projected economic development of the basin, especially surface mining of coal, will impact the physical environment. Depending upon the amount and location of land disturbed, an estimated 10,000 to 30,000 tons per year of additional sediment will be contributed to the mainstem Yampa River. (Woodard-USGS)
W79-06825

MAN, RUNOFF AND THE EROSION OF THE COASTAL SLOPES OF ASHKELON, ISRAEL,
Tel Aviv Univ. (Israel). Dept. of Geography.
A. L. Marcus.
Geojournal, Vol. 2, No. 6, p 569-573, 1978. 10 fig, 6 ref.

Descriptors: *Coasts, *Shore protection, *Accelerated erosion, *Beaches, *Runoff, *Grazing, Coastal plains, Beach erosion, Coastal engineering, Slopes, Wind erosion, Erosion control, Hydrogeology, Waves(Water), Overland flow, Pastures, Social impact, Recreation wastes, Recreation demand, Urbanization, Israel.

Because of intensified recreational and bedouin grazing use of coastal areas, exemplified in this paper by a study of the Ashkelon area south of Tel-Aviv, beach erosion has become a serious problem for the Israelis. Increasing urbanization has introduced factors that contribute to slope runoff in sufficient volume to initiate slope erosion. Effects of such enlarged runoff volume include erosion of backslope areas and deposition of large alluvial fans on the beach footslope. Underlying sandstone cliffs are exposed and gullies deepened. Establishment of parking lots, storm sewer outlets, and stairways to beach areas have additional impact on the process, so that what first appears to be practical and normal recreational uses, instead create a series of unexpected and detrimental effects on this sensitive coastal environment. The effect of intensified bedouin grazing practices on dunes inland and along coastal cliffs, while less obvious and immediate, is nevertheless potentially detrimental also, as the vegetative cover is foraged and the sandy surface exposed to wind and water erosion. These two man-environment interactions have created a destabilization-denudation process of the entire hill chain in the area under study. (Tickes-Arizona)
W79-06838

2K. Chemical Processes

CHLORIDE AS A FACTOR IN MOBILITIES OF NI(II), CU(II), AND CD(II) IN SOIL,
California Univ., Berkeley. Dept. of Soils and Plant Nutrition.
H. E. Doner.
Soil Science Society of America Journal, Vol 42, No 6, p 882-885, November-December, 1978. 5 fig, 3 tab, 15 ref.

Descriptors: *Trace elements, Metals, *Chlorides, Adsorption, Ion transport, Leachate, Chemical analysis, *Soil analysis, Laboratory tests.

The mobility of chloro-complexes of Ni(II), Cu(II), and Cd(II) through soil was studied. Soil columns were leached with 0.1, 0.2, 0.3, or 0.5M NaCl or CaClO4 solutions, each containing 10 microgram/ml Ni(II), Cu(II), or Cd(II). Sodium perchlorate solutions were used as a comparison with CaCl at the same ionic strength since perchlorate is not considered to form complexes with the metals. Leachates from columns and soils were collected and analyzed. Mobility of all metals tested in chloride solutions was from 1.1 to 4 times greater than that in ClO4(-) solution. Chloride increased the mobility of Cd(II) the most which corresponds to its having the largest stability constants. Copper (II) was slowest to appear in the leachate and was strongest asdorbed as evidenced by analysis of soil by digestion with either 4N HNO3 or acidified NH2OH-HCl. These results showed that Cl(-) has a marked effect on the mobility of Cd(II) and, to a lesser extent, Ni(II) and Cu(II). (Skogerboe-Colorado State)
W79-06553

LONG-TERM DENITRIFICATION STUDIES IN SOILS FERTILIZED WITH (15NH4)2SO4,
California Univ., Riverside. Dept. of Soil and Environmental Sciences.
D. D. Focht, and L. H. Stolzy.
Soil Science Society of America Journal, Vol 42, No 6, p 894-898, November-December, 1978. 6 fig, 1 tab, 31 ref.

Descriptors: *Denitrification, Nitrogen, Nitrates, *Nitrogen cycle, Soil gases, Lysimeters, Isotope studies, Fertilization.

A 2-year study was conducted in lysimeters containing four different soils with successive summer and winter crops of corn and barley, respectively. The crops were fertilized with (15NH4)2SO4 at application rates equivalent to 134, 108, 415, and 440 Kg N/ha for the respective summer 1973, winter 1974, summer 1974, and winter 1975 crops. The frequency of 15N dinitrogen samples was higher in the summer and higher at the lower fertilizer rates, while the reverse was true for NO3(-) concentrations in leach water and N2O concentrations in the soil profile. Emissions of N2O from soil, even where the higher concentrations were observed, were low in terms of N losses with the greatest mass emission at any time amounting to 6.5 g/ha over a 1-day period. Nitrogen gas emissions over a 1-week period in one instance were estimated at 5.2 kg N/ha; it was observed that this amount could be generated from low (1 ppm or less) concentrations of N2O. (Skogerboe-Colorado State)
W79-06554

SERIOUS INTERFERENCES IN THE DETERMINATION OF TRACE METALS IN SOILS BY FLAME AND FLAMELESS ATOMIC ABSORPTION SPECTROMETRY,
Montana Coll. of Mineral Science and Technology, Butte. Dept. of Chemistry.
For primary bibliographic entry see Field 2G.
W79-06555

IONIC STABILITY OF PRECIPITATION SAMPLES,
Illinois State Water Survey, Urbana. Atmospheric Sciences Section.
M. E. Peden, and L. M. Skowron.
Atmospheric Environment, Vol. 12, No. 12, p 2343-2349, 1978. 6 fig, 10 ref. EY-76-S-02-1199.

Descriptors: *Chemistry of precipitation, *Sampling, *Chemical analysis, *Ions, Precipitation(Atmospheric), Rainfall, Snowfall, Chemicals, Filtration, Data collections, Equipment, Dusts, Air pollution, Fallout, Chemistry, Meteorology, Ionic stability, Precipitation sampling.

Event and weekly precipitation sampled with 3 types of collectors was stored under 5 different conditions and analyzed throughout a 6-week time period to monitor changes in ionic composition. Ca(++), Mg(++), Na(++), K(+), H(+), NH4(+), SO4(--), NO3(-), and Cl(-) were the constituents under observation. Dramatic variations in the concentrations of some species are attributable to the sample particulate loading. Although cooling retarded changes in ionic composition, immediate filtering after wet-only collection was the most effective means of retaining sample integrity and preventing adsorption-desorption reactions. (Sims-ISWS)
W79-06602

COMBINED MEASUREMENT OF OXYGEN AND SULFIDE IN WATER SAMPLES,
Aarhus Univ. (Denmark). Inst. of Ecology and Genetics.
K. Ingvorsen, and B. B. Jorgensen.
Limnology and Oceanography, Vol. 24, No. 2, p 390-393, March 1979. 3 fig, 17 ref.

Descriptors: *Chemical analysis, *Oxygen, *Sulfides, Water chemistry, Laboratory tests, Sampling, On-site data collections, On-site investigations, Hydrogen sulfide, Dissolved oxygen, Water quality, Chemistry.

A method was described for chemical determination of oxygen and sulfide in the same water sample. Sulfide is first separated by precipitation with zinc hydroxide, oxygen then determined by the Winkler technique in the clear supernatant. The mutual interference between the oxygen and the sulfide determinations is less than 1-2%. The method has proven useful for field applications: as an example, the diurnal variation in oxygen and sulfide of a shallow lagoon was presented. (Sims-ISWS)
W79-06699

A KINETIC STUDY OF THE CAC03 PRECIPITATION REACTION,
Arkansas Univ., Fayetteville. Dept. of Agronomy.
J. T. Gilmour, K. S. Shirk, J. A. Ferguson, and C. L. Griffis.
Agricultural Water Management, Vol. 1, No. 3, p 253-262, November, 1978. 2 fig, 4 tab, 10 ref.

Descriptors: *Chemical precipitation, Chemical reactions, Soil chemistry, *Calcium carbonate, Magnesium carbonate, Mathematical models, Rice.

In order to develop water management practices which would minimize localized precipitation of Ca and Mg carbonates on Arkansas' rice fields, a description of the precipitation reaction was needed. Waters studied were prepared solutions which contained varying amounts of Ca(HC03)2 and/or MgC12, and subterranean water samples collected in the field. These waters were monitored for Ca and Mg loss due to carbonate precipi-

tation under unseeded spontaneous conditions. The rate of Ca loss from solution was adequately described by first order kinetics where Ca was the rate determining ion. An empirical equation was developed which showed the rate constant could be calculated from temperature and solution composition data. An evaluation of the rates of Ca and Mg loss from solution for the experimental periods studied showed that Mg losses were small when compared to Ca losses. (Skogerboe-Colorado State)
W79-06703

A SOIL-WATER-NITROGEN MODEL FOR IRRIGATED CORN ON SANDY SOILS,
Nebraska Univ., Lincoln. Dept. of Agricultural Engineering.
D. G. Watts, and R. J. Hanks.
Soil Science Society of America Journal, Vol. 42, No. 3, p 492-499, May-June, 1978. 8 fig, 25 ref, 1 append. OWRT B-024-NEB(2). 14-31-0001-4101.

Descriptors: *Nitrogen, Nitrates, Leaching, Model studies, *Soil-water-plant relationships, Sweet corn, Water balance, Irrigation.

A model was developed which describes the net changes of nitrogen amounts due to transformations and the movement, uptake, and loss of nitrogen from the root system of irrigated corn (Zea mays L.) grown on sandy soils. A potential nitrogen uptake function developed from field data is used to determine the maximum uptake for nonlimiting soil water and nitrogen availability. Actual uptake is calculated as less than potential when soil water content and/or mineral nitrogen concentration and distribution limit convective and diffusive movement of nitrate to the root system. Separate calculations are made for uptake resulting from each of these two mechanisms. Seasonal nitrogen uptake was computed within 15% of measured uptake on field plots where uptake by above ground plant material ranged from 105 to 218 kg/ha. Computed nitrate leaching losses compared favorably with losses estimated by multiplying percolation loss determined from a weekly water balance, by measured nitrate concentration at 150 cm depth. Field leaching losses estimated by the water balance-concentration method ranged from 37 to 154 kg/ha. (Skogerboe-Colorado State)
W79-06736

RATES OF WEATHERING AND SOIL FORMATION ON GRANITE IN RHODESIA,
Science and Education Administration, Coschocton, OH.
For primary bibliographic entry see Field 2A.
W79-06741

THE INFLUENCE OF ELECTROLYTE CONCENTRATION ON FLOCCULATION OF CLAY SUSPENSIONS,
California Univ., Riverside. Dept. of Soil and Environmental Sciences.
For primary bibliographic entry see Field 2G.
W79-06761

GROUND-WATER QUALITY IN BANNOCK, BEAR LAKE, CARIBOU, AND PART OF POWER COUNTIES, SOUTHEASTERN IDAHO,
Geological Survey, Boise, ID. Water Resources Div.
For primary bibliographic entry see Field 7C.
W79-06814

MARYLAND GROUND-WATER INFORMATION: CHEMICAL QUALITY DATA,
Geological Survey, Towson, MD. Water Resources Div.
R. S. Woll.
Maryland Geological Survey Water Resources Basic-Data Report No 10, 1978. 126 p, 27 tab, 4 ref.

Descriptors: *Water quality, *Groundwater, *Chemical analysis, *Maryland, Data collections, Water wells, Geologic units, Water analysis, Physical properties, Sampling, Sites, Maps, Basic data collections.

Water-quality data from approximately 1600 wells and springs in Maryland are tabulated. The data represent all the ground-water samples collected and analyzed by the U.S. Geological Survey in Maryland during the period 1942-1974. (Woodard-USGS)
W79-06820

2L. Estuaries

FLUCTUATIONS OF CHLOROPHYLL AND RELATED PHYSICAL PARAMETERS IN BRITISH COLUMBIA COASTAL WATERS,
British Columbia Univ., Vancouver. Inst. of Oceanography.
R. C. Wiegand, and S. Pond.
Journal of the Fisheries Research Board of Canada, Vol. 36, No. 2, p 113-121, February 1979. 7 fig, 29 ref.

Descriptors: *Water quality, *Straits, *Canada, *On-site tests, On-site investigations, Data collections, Salinity, Water temperature, Dissolved oxygen, Chlorophyll, Profiles, Spatial distributions, Water properties, Bodies of water, Analysis, Sampling, Methodology, Statistical methods, Water sampling, Fluctuations, Coasts, Analytical techniques, *British Columbia, *Strait of Georgia(British Columbia), Spectral analysis.

Continuous horizontal profiles of chlorophyll, temperature, salinity, and oxygen were made at 3 depths and in 3 locations in British Columbia coastal waters, and spectra and cross-spectra were calculated. Generally, fairly strong relationships exist between chlorophyll and temperature and salinity, especially at scales of order 10-1000 m. However, the relationships are not always expressed through the same physical parameter. It is apparent from coherence and phase data that in a turbulent environment, the vertical profiles of the parameters are important in determining the nature of the relationships. Average spectra show power law relationships similar to the results of other authors. Profiling fairly rapidly, as well as moving horizontally, would allow better resolution of both horizontal and vertical variations and was recommended for future investigations. (Humphreys-ISWS)
W79-06644

SPECTRAL AND BIOCHEMICAL CHARACTERISTICS OF THE PARTICULATE MATTER IN BEDFORD BASIN,
Biochimie Marine, Villefranche-sur-Mer (France). Station Zoologique.
P. Mayzaud, and S. Taguchi.
Journal of the Fisheries Research Board of Canada, Vol. 36, No. 2, p 211-218, February 1979. 3 fig, 5 tab, 24 ref.

Descriptors: *Phytoplankton, *Organic matter, *Carbohydrates, *Estuaries, Proteins, Carbon, Microorganisms, Aquatic microorganisms, Chlorophyll, Temperature, Salinity, Density, Diatoms, Dinoflagellates, Plankton, Water quality, *Bedford Basin, Copepods, Tintinnids.

A survey of the distribution, nature, and biochemical composition of particulate matter (less than 153 micrometers diam) showed that small particles (less than 18 micrometers) made up the bulk of the particulate matter during most of the summer. Relatively large amounts of microzooplankton (tintinnids) were also recorded during the period of stable hydrographic conditions. Diatoms and dinoflagellates were abundant only in early fall prior to the fall bloom. All cell counts were transformed into parts per million on a volume basis to compare with Coulter Counter data. Cell counts on preserved samples strongly underestimated the number and volume of small particles and did not take into account the detritus. Considerations of the ATP content strongly suggested that for naturally occurring particulate matter there is not a constant ATP to carbon ratio, but rather there is an upper and lower limit. Small particles were the main repository for protein, whereas phytoplankton was the repository for carbohydrates. The high variability of both quality and quantity of particles in the neritic habitat suggests that a single chemical variable cannot describe fully the nutritive value of naturally occurring suspended matter. (Sims-ISWS)
W79-06645

SUMMER PLANKTON DISTRIBUTIONS ASSOCIATED WITH THE PHYSICAL AND NUTRIENT PROPERTIES OF THE NORTHWESTERN GULF OF ST. LAWRENCE,
Quebec Univ., Rimouski. Dept. of Oceanography.
J. M. Sevigny, M. Sinclair, M. I. El-Sabh, S. Poulet, and A. Coote.
Journal of the Fisheries Research Board of Canada, Vol. 36, No. 2, p 187-203, February 1979. 14 fig, 2 tab, 28 ref.

Descriptors: *Plankton, *Nutrients, *Physical properties, *Gulfs, *Estuaries, *St. Lawrence River, Sampling, Surveys, Data processing, Phytoplankton, Diatoms, Dinoflagellates, Aquatic microorganisms, Biomass, Currents(Water), Water circulation, Density, Salinity, Phosphates, Silicates, Nitrates, Water quality, *Gulf of St. Lawrence, Copepods.

Two transects, north-south and east-west, through the Anticosti gyre and the Gaspe current were sampled for physical properties, nutrient, and plankton concentrations over a 5-day period during July 1976. Temperature, salinity, sigma sub t and nutrient isolines formed a dome characteristic of cyclonic circulation with the apex within the Anticosti gyre, but a strong shallow thermocline prevented nutrient enrichment of the surface mixed layer. Surface nitrate and silicate concentrations were very low, except for 2 anomalies throughout the region sampled, with phosphate concentrations higher. Phytoplankton biomass was uniformly low and dominated by nannoplankton (less than 15 micrometers) was important and the total biomass considerably higher. The higher biomass and importance of larger celled species suggest higher nutrient turnover in the Gaspe current. Nitzschia delicatissima dominated the species composition in the Gaspe current, dinoflagellates and microflagellates being of more importance within the gyre and along the north shore. Zooplankton biomass was distributed fairly uniformly over the entire region, but species composition at the shallower stations was characterized by small copepod species and fish larvae, the gyre stations being characterized by larger copepod species, euphausids, and decapod larvae. (Sims-ISWS)
W79-06646

DISTRIBUTION OF NUTRIENTS IN THE GULF OF ST. LAWRENCE,
Bedford Inst. of Oceanography, Dartmouth (Nova Scotia). Atlantic Oceanographic Lab.
A. R. Coote, and P. A. Yeats.
Journal of the Fisheries Research Board of Canada, Vol. 36, No. 2, p 122-131, February 1979. 11 fig, 1 tab, 20 ref.

Descriptors: *Nutrients, *Distribution patterns, *Gulfs, *Estuaries, *St. Lawrence River, Sampling, Surveys, Data processing, Silicates, Nitrates, Phosphates, Winter, Summer, Water quality, Path of pollutants, Sediments, *Gulf of St. Lawrence.

The general pattern of nutrient distribution in the Gulf of St. Lawrence results from regeneration processes being superimposed on the physical processes of estuarine circulation within the Gulf. This leads to a general increase in nutrient concentration with depth and with distance into the Gulf from Cabot Strait. Nutrient concentrations in the Laurentian Channel are higher inside the Gulf than at equal or even greater depths in the Atlantic Ocean some distance outside Cabot Strait. Summer nutrient concentrations in the surface layer are generally low. However, during the winter when biological activity is low, quite high concentrations of the nutrients are found in the surface waters of the Gulf. A balance exists between inward and

outward fluxes of all 3 nutrients through Cabot Strait in the winter. However, in the summer, the influxes of both nitrate and silicate at Cabot Strait greatly exceed the outgoing fluxes. Losses of biogenic silica to the sediments may account for the silicate imbalance. Excess nitrate may be accounted for if ammonia or nitrogen bound with dissolved organics had been measured. (Sims-ISWS)
W79-06650

LINE PLUME AND OCEAN OUTFALL DISPERSION,
Georgia Inst. of Tech., Atlanta. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5B.
W79-06651

CARBON AND OXYGEN ISOTOPE RATIOS IN THE SAGUENAY FJORD AND THE ST. LAWRENCE ESTUARY AND THEIR IMPLICATIONS FOR PALEOENVIRONMENTAL STUDIES,
Bedford Inst. of Oceanography, Dartmouth (Nova Scotia). Atlantic Oceanographic Lab.
P. M. Strain, and F. C. Tan.
Estuarine and Coastal Marine Science, Vol. 8, No. 2, p 119-126, February 1979. 3 fig, 3 tab, 13 ref.

Descriptors: *Isotope studies, *Estuaries, *St. Lawrence River, *Canada, Carbon, Oxygen, Carbon dioxide, Sampling, Surveys, Mathematical models, Paleoclimatology, Water temperature, Salinity, Climatology, *St. Lawrence Estuary, *Saguenay Fjord.

Surface water samples (1 m depth) from the Saguenay Fjord and the upper St. Lawrence Estuary were analyzed for delta 13C, Sigma C02, and delta 180. In the Saguenay Fjord, the delta 13C sub PDB and concentration of the total dissolved C02 varied from -10.9 parts per thousand and 3.6 ml/l near the head to -0.4 parts per thousand and 30.3 ml/l at the mouth. The upper St. Lawrence Estuary exhibited a delta 13C range of -4.2 to -1.6 parts per thousand and a sigma C02 concentration range of 19.8 to 37.6 ml/l. The measured delta 13C, sigma C02, delta 180 and salinity distributions were compared to a conservative mixing model. The excellent agreement between the measured and predicted delta 13C values in the Saguenay Fjord indicated that the carbon isotope ratio behaves conservatively. In the upper St. Lawrence Estuary, the much poorer agreement suggested that significant in situ processes involving the dissolved C02 are operative. The suggestion that estuarine paleotemperatures may be obtained by extrapolating delta 13C - delta 180 shell carbonate curves to marine conditions is open to criticism. The delta 13C - delta 180 water curves observed in this work illustrated two different situations that could produce errors in paleotemperatures estimated by this method. (Sims-ISWS)
W79-06654

CONCENTRATIONS AND TEMPORAL VARIATIONS OF 210PO, 210PB, AND AL IN THE SURF ZONE ECOSYSTEM OF COPALIS BEACH, WASHINGTON,
Washington Univ., Seattle. Dept. of Oceanography.
J. T. Bennett, and R. Carpenter.
Estuarine and Coastal Marine Science, Vol. 8, No. 2, p 127-140, February 1979. 2 fig, 3 tab, 38 ref. ERDA E(45-1)-2225-TA24, EPA T900313-04.

Descriptors: *Diatoms, *Lead, *Aluminum, *Surf, *Washington, Benthos, Beaches, Coasts, Phytoplankton, Isotope studies, Sampling, Surveys, Seasonal, Aquatic microorganisms, Aquatic life, *Copalis Beach(WA), *Polonium.

Surf diatoms monitored during a 21-month period at Copalis Beach, Washington, contained elevated concentrations of Al, 210Pb, and supported 210Po compared to net phytoplankton from Washington coastal waters and Puget Sound. Aluminum concentrations of several percent dry weight found in the surf diatoms were not a reflection of contamination by discrete inorganic particulate matter but were the result of a natural coating of clay-sized particles on Chaetoceros armatum, the predominant diatom in the surf blooms. A high correlation between Al and 210Pb in the surf diatoms suggests that 210Pb and supported 210Po were also associated with the clay-sized particles. During fall through spring, the unsupported 210Po concentrations in the surf diatoms were correlated with the input of 210Po by precipitation. A summer maximum in unsupported 210Po concentrations in the surf diatoms may reflect upwelling that causes higher dissolved 210Po concentrations in the summer surf relative to those of late spring and early fall. The consumers of the surf diatoms exhibited larger 210Po-activity-to-210Pb-activity ratios than their food, indicating 210Po was preferentially accumulated in the higher trophic level. (Sims-ISWS)
W79-06655

EFFECTS OF SEWAGE SLUDGE ON THE BENTHIC INVERTEBRATE COMMUNITY OF THE INSHORE NEW YORK BIGHT,
Brooklyn Coll., NY. Dept. of Biology.
For primary bibliographic entry see Field 5A.
W79-06656

SEASONAL FLUCTUATIONS IN COASTAL BENTHIC INVERTEBRATE ASSEMBLAGES,
Delaware Univ., Lewes. Marine Studies Complex.
D. Maurer, W. Leathem, P. Kinner, and J. Tinsman.
Estuarine and Coastal Marine Science, Vol 8, No 2, p 181-193, February 1979. 3 fig, 6 tab, 20 ref.

Descriptors: *Marine animals, *New York, *New Jersey, *Invertebrates, *Benthic fauna, *Atlantic Ocean, Sediments, Benthos, Sampling, Surveys, Marine biology, Classification, Data processing, Seasonal, Biology.

During 4 quarterly sampling cruises at 2 areas off the Delaware coast, 288 quantitative benthic invertebrate samples were collected. Species composition, species dominance (abundance and frequency of occurrence), density, and species evenness were compared. Based on cluster analysis, 3 species-site groups emerged: (1) a high energy shoal assemblage characterized by a year-round suite of haustoriids and a few bivalves, (2) a mixed hard bottom-sand assemblage that featured marked seasonal dominance of Mytiilus edulis with a variety of seasonal epifaunal and infaunal species, and (3) a medium sand assemblage with a variety of seasonal infaunal species. Similar assemblages have been recognized off New Jersey and New York. Seasonal fluctuations in undisturbed coastal invertebrate assemblages can be so marked that many environmental impact studies are inadequate to assess the effects of human activities. (Sims-ISWS)
W79-06657

METEOROLOGICAL FORCING OF COASTAL WATERS BY THE INVERSE BAROMETER EFFECT,
Harbor Branch Foundation, Fort Pierce, FL.
N. P. Smith.
Estuaries and Coastal Marine Science, Vol 8, No 2, p 149-156, February 1979. 3 fig, 13 ref.

Descriptors: *Water levels, *Atmospheric pressure, *Gulf of Mexico, *Texas, *Florida, Tides, Variability, Winds, Pressure, Atmosphere, Coasts, Time series analysis, Analytical techniques, Data processing, Data collections, Oceanography, Air-sea interaction.

Water level and surface pressure data from the northeastern and northwestern Gulf of Mexico were used to investigate the water level response to meteorological forcing by the inverse barometer effect. Statistically significant coherence-squared values were computed for variations in cross-Gulf surface pressure and water level differences over time scales on the order of 2 to 6 days. Water level variations of approximately + or -4-5 cm were postulated for the northern Gulf of Mexico in response to surface pressure differences. Meteorological forcing by the inverse barometer effect appeared to be significantly greater in the winter months, when cross-Gulf air pressure differences of up to + or -20 mb were recorded. (Sims-ISWS)
W79-06658

VENICE: SEA-LAGOON EXCHANGE IN A MODIFIED TIDE RANGE,
Consiglio Nazionale delle Richerche, Venice (Italy). Lab. per lo Studio della Dinamica delle Grandi Masse.
O. Vittori, and F. Tampieri.
Science, Vol. 204, No. 4390, p 261-264, April 20, 1979. 2 fig, 19 ref.

Descriptors: *Tidal waters, *Lagoons, *Model studies, *Water quality, *Europe, Analytical techniques, Salinity, Water levels, Tides, Tidal effects, Mathematical models, Freshwater, Water level fluctuations, Inlets(Waterways), Foreign research, Estuaries, *Italy, *Venetian Lagoon(Italy).

Salinity and tide heights recorded for a month at P, a point in the northern section of the Venetian lagoon, are the basic experimental data used to construct a numerical model which describes the salinity variations at P as a function of the tides measured at the Lido entrance. The time variation of the salinity pattern was interpreted in terms of a lagoon system in which a freshwater source of constant intensity is in a quasi-steady equilibrium with a tide-modulated sink. The mean residence time of a contaminant in this simulated lagoon was predicted from the change in the salinity pattern due to a reduction in the entrance size. The limits of the present results were set by the limitation of the available data and by the consequent necessity of highly simplified modeling. The data may not be sufficient to properly represent P. However, owing to the lack of a large-scale study and the necessity for the Italian government to make a decision within a short time, it was considered necessary to present the simplified modeling approach. This approach has the purpose of producing evidence that a nonlinear effect may occur in the sea-lagoon exchange as a consequence of a reduction in the entrance size. Moreover, it supports the action of those, in Italy and elsewhere, who require that pollution concentrations in the Venetian lagoon be quantitatively predicted before any permanent change in the lagoon tide regime is made. (Humphreys-ISWS)
W79-06659

COMBINED MEASUREMENT OF OXYGEN AND SULFIDE IN WATER SAMPLES,
Aarhus Univ. (Denmark). Inst. of Ecology and Genetics.
For primary bibliographic entry see Field 2K.
W79-06699

TEMPERATURE FINE STRUCTURE NEAR THE SEA-ICE MARGIN OF THE CHUKCHI SEA,
Naval Postgraduate School, Monterey, CA. Dept. of Oceanography.
R. G. Paquette, and R. H. Bourke.
Journal of Geophysical Research, Vol. 84, No. C3, p 1155-1164, March 20, 1979. 15 fig, 1 tab, 24 ref. N66001-76-PO-00610.

Descriptors: *Water temperature, *Sea ice, *Salinity, Surveys, Sampling, On-site investigations, Ice, Melting, Oceans, Temperature, Distribution patterns, Temporal distribution, Spatial distribution, Variability, Oceanography, *Chukchi Sea.

Temperature fine structure with peak-to-peak fluctuations often exceeding 2C is prevalent throughout the marginal sea-ice zone of the shallow Chukchi Sea in midsummer. It is normally found within 20-35 km outside of the ice and seldom farther than 5-10 km inside the ice margin. It has also been infrequently found more than 100 km south of the ice. Temperature and salinity fronts of all degrees of sharpness occur in the same general area, but the two types need not be coincident. Considerable variability in time and length scales of fine structure elements has been noted with persistences ranging from 2 hours or less to more than 20 hours

and length scales ranging from 600 m to more than 20 km. While much of this variability is intrinsic, part can be accounted for by the inability to sample in the direction of flow and the relative motion between the sampling platform and fine structure element. Fine structure lenses are considerably longer parallel to the ice edge, with similarity in temperature structure noted over distances of 80 and 100 km. (Sims-ISWS)
W79-06739

A DYNAMICAL ANALYSIS OF CURRENTS NEAR THE NEW JERSEY COAST,
National Oceanic and Atmospheric Administration, Ann Arbor, MI. Great Lakes Environmental Research Lab.
J. R. Bennett, and B. A. Magnell.
Journal of Geophysical Research, Vol. 84, No. C3, p 1165-1175, March 20, 1979. 9 fig, 2 tab, 6 ref. BNL 357213-S.

Descriptors: *Ocean currents, *Currents(Water), *New Jersey, *Coasts, *Model studies, Mathematical models, Winds, Circulation, Water circulation, Ocean circulation, Shores, Oceans, Shear, Stress, On-site investigations, On-site data collections, Data processing, Analytical techniques, Oceanography, *New York Bight.

A numerical model was used to analyze currents measured on the continental shelf near the shore of New Jersey. The model neglected longshore variations of current and all variations of density, but it included inertial accelerations and a nonlinear eddy viscosity. Local wind stress, sea level changes, and a constant longshore pressure gradient were the forcing terms. The model successfully reproduced most of the current variances. However, the predicted currents did not exhibit the dominant 4-hour response time of the observed currents, and the model sometimes missed energetic current events. These differences were ascribed to three-dimensional setup effects elsewhere in the New York Bight. (Sims-ISWS)
W79-06740

THE MEASUREMENT OF INTERACTIVE FRESHWATER AND TIDAL FLOWS IN THE RIVER DEE, NORTH WALES,
Welsh National Water Development Authority, Cardiff. Dee and Clwyd Sewage Div.
A. E. Weston.
Journal of the Institution of Water Engineers and Scientists, Vol. 33, No. 1, p 69-79, January 1979. 8 fig, 1 ref.

Descriptors: *Rivers, *Tidal waters, *Estuaries, *Water levels, Tidal effects, Freshwater, Discharge(Water), Tides, Data collections, On-site investigations, Analytical techniques, Chlorides, Water quality, Saline water intrusion, Tidal streams, Watersheds(Basins), Rating curves, Foreign research, Foreign countries, *Wales, *River Dee(Wales), Flow reversal.

The area of interaction between tides and freshwater flows ranges from Hilbre Island, at the mouth of the Dee Estuary, to Pickhill, 70 km inland and 30 km upstream of the ancient weir at Chester, which greatly influences the hydraulics of the reach. Freshwater flows down the Dee would normally vary naturally between 2 and 180 cu m/sec, and tide levels at Liverpool (equivalent to the mouth of the estuary) vary from 6.24 m AOD Newlyn (at a return period of 1 in 100 years) to 1.60 m AOD Newlyn at neap tides. The Dee, being a regulated river, supports continuous abstractions by statutory water undertakings of 6 cu m/sec at present from the lower reaches upstream of Chester Weir. This will rise to 8.5 cu m/sec by the early 1980's, making the Dee the largest single source of potable water in Wales or Northern England. In addition, industrial abstractions of 4.5 cu m/sec take place from the estuary downstream of Chester Weir. The paper discussed the development of operational systems needed to forecast tidal peaks, tidal-affected river levels, and saline intrusions from a series of relatively simple hydrometric and chemical measurements. Although there is considerable scope for the extension of this work into a computer-based mathematical modelling system, the value of accurate basic measurements, interpreted rationally and presented concisely, should not be underestimated. The paper indicated how a quantitative understanding of the relationship between tidal and freshwater flows in the lower Dee has been gained from simple but precise hydrometric observations and standard chemical sampling. With the exception of the ultrasonic discharge meter, no large capital investment has been necessary. The results obtained provide a useful set of simple operational prediction methods which are extensively used in the Authority's day-to-day management of the Dee system. The work could also form a basis for the development and refinement of any mathematical model of the tidal section of the river. (Humphreys-ISWS)
W79-06747

EXPERIMENTAL NUMERICAL SIMULATION OF UNSTEADY WATER FLOW IN A MULTIBRANCH RIVER DELTA,
V. V. Ivanov, and Ye. P. Kotrekhov.
Soviet Hydrology: Selected Papers, Vol. 16, No. 2, p 141-150, 1977. 4 fig, 4 tab, 9 ref. Translated from Transactions of the Arctic and Antarctic Scientific Research Institute (Trudy AANII), Vol. 314, p 16-35, 1976.

Descriptors: *Estuaries, *Rivers, *Unsteady flow, *Model studies, Deltas, Flow, Mathematical models, Theoretical analysis, Analytical techniques, Foreign research, Discharge(Water), Tidal waters, Waves(Water), Water levels, Wind tides, Water level fluctuations, *USSR, *Kolyma Estuary(USSR), Multibranch river delta.

The most suitable among the computation methods developed in the USSR for creating a mathematical model of an intricately branching delta is that of the Institute of Hydrodynamics of the Siberian Branch of the USSR Academy of Sciences. This method (IH) has been used successfully to study the interaction between aperiodic sea level fluctuations and river runoff on a numerical model of a single-arm estuary. The estuary of the Kolyma River was used to investigate the possibility of applying the modification of the IH method to the mathematical simulation of unsteady water flow in a multibranch delta. To describe one-dimensional flow in a river estuary, the St. Venant equations were written for an arbitrary system of channels. The computation scheme and the initial data forming the basis of the mathematical model of the Kolyma estuary were presented. The use of numerical simulation of the water regime of intricately branched deltas, based on methods of computation of unsteady flow, makes it possible to obtain the characteristics of one-dimensional flow. The method investigated makes it possible to supplement existing information and sometimes to obtain completely new information on the hydraulic regime of flow in the intricately branched deltas of large rivers. In this case, one can investigate some important patterns along river estuaries of propagation of long waves produced by wind set-up, floods, and tides. All this indicates the great potential of the method for solving some practical problems associated with water transport, hydraulic power engineering, and other branches of industry. (Humphreys-ISWS)
W79-06749

AN EXPERIMENTAL STUDY OF BRINE DRAINAGE AND CONVECTION IN YOUNG SEA ICE,
Washington Univ., Seattle. Dept. of Oceanography.
For primary bibliographic entry see Field 2C.
W79-06757

ON THE NUMERICAL COMPUTATION OF TWO-LAYER NEARLY HORIZONTAL FLOWS,
Seaconsult Marine Research Ltd., Vancouver (British Columbia).
For primary bibliographic entry see Field 2E.
W79-06758

DESIGN WAVE HEIGHT AND WAVE PERIOD OF SEA WAVES AT DIGHA,
River Research Inst., Calcutta (India). Haringhata Central Lab.
S. K. Daskaviraj, and S. K. Sarkar.
Indian Journal of Meteorology, Hydrology and Geophysics, Vol. 29, No. 3, p 541-546, July 1978. 9 fig, 6 ref.

Descriptors: *Waves(Water), *Ocean waves, *Beaches, Design data, Statistics, Probability, Measurement, Frequency, Data processing, Curves, Coasts, Coastal engineering, *India, *Digha(India), Design wave height.

The most probable height and period of the waves which will occur in any given length of time were determined from systematic instrumental records of sea waves at Digha. In determining the design wave height and wave period the method as suggested by Draper was used. Cumulative distribution of the highest and the significant wave heights and the distribution of wave periods in percentage of occurrence also were presented. (Sims-ISWS)
W79-06770

AN ENVIRONMENTAL SURVEY OF CANTON ATOLL LAGOON, 1973.
Naval Undersea Center, Kailua, HI. Hawaii Lab.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A028 023, Price codes: A09 in paper copy, A01 in microfiche. Final Report NUC TP 395, Naval Undersea Center, Hawaii Laboratory, Kailua, Hawaii, June 1976, 200 p. Smith, S. V. and Henderson, R. S., editors. DOAF, MIPR FY7616-74-00-202, EPA R800906.

Descriptors: *Atolls, *Lagoons, *Water quality, *Geomorphology, *Aquatic environment, Tidal waters, Biota, Aquatic life, On-site investigations, Hydrologic budget, Reefs, Coral, Surveys, Analytical techniques, Suspended solids, Water properties, Groundwater, Surface waters, Estuaries, *Canton Atoll.

Canton Atoll has a single passage between the ocean and lagoon and has conspicuous environmental gradients from that passage to the back lagoon. These gradients include the physiography of the lagoon floor, water quality, and the diversity and abundance of corals, fishes, and mollusks. The gradients apparently can be attributed either directly or indirectly to circulation and water motion within the lagoon. Those oceanographic characteristics, in turn, can be attributed to the geological history of the atoll, including some human modification of the pass configuration. In addition to the studies of the atoll lagoon, the characteristics of the groundwater system were noted. Evidence from isolated standing water bodies on the atoll demonstrates that these features show considerable variability, which may be attributed to a combination of the immediately previous history of these bodies as well as to the physiography of the atoll. (See W79-06882 thru W79-06888) (Humphreys-ISWS)
W79-06881

CANTON ATOLL LAGOON PHYSIOGRAPHY AND GENERAL OCEANOGRAPHIC OBSERVATIONS,
Naval Undersea Center, Kailua, HI. Hawaii Lab.
R. S. Henderson, P. L. Jokiel, S. V. Smith, and J. G. Grovhoug.
In: An Environmental Survey of Canton Atoll Lagoon, 1973. Final Report NUC TP 395, Naval Undersea Center, Hawaii Laboratory, Kailua, Hawaii, p 5-14, June 1976. 6 fig, 2 ref.

Descriptors: *Atolls, *Lagoons, *Geomorphology, *Tidal waters, Tides, Reefs, Dredging, Inlets(Waterways), Surveys, Water circulation, On-site investigations, Water levels, *Canton Atoll.

The 4 major physiographic zones of the Canton Atoll lagoon are defined as the Pass Zone, the Line Reef Zone, the Back Lagoon Zone, and the Altered Zone. Each of these zones has a characteris-

tic physiography, biota, and water quality. The Altered Zone is noteworthy, because it appears to have originated from the degradation of other zones brought about by dredge and fill operations. There does not appear to be any other major artificial damage to the lagoon, aside from direct mechanical destruction by dredging. The predominant aspects of lagoon circulation are wind drift and tidal flow. Although lagoon tides show a pronounced lag with respect to the ocean tides, there is no measurable amplitude attenuation from the ocean to the back lagoon. (See also W79-06881) (Humphreys-ISWS)
W79-06882

WATER COMPOSITION AND BIOGEOCHEMICAL GRADIENTS IN THE CANTON ATOLL LAGOON,
Naval Undersea Center, Kailua, HI. Hawaii Lab.
S. V. Smith, and P. L. Jokiel.
In: An Environmental Survey of Canton Atoll Lagoon, 1973. Final Report NUC TP 395, Naval Undersea Center, Hawaii Laboratory, Kailua, Hawaii, p 15-53, June 1976. 19 fig, 6 tab, 51 ref.

Descriptors: *Atolls, *Lagoons, *Water properties, *On-site investigations, Water quality, Sedimentation, Analysis, Analytical techniques, Aquatic environment, Tidal waters, Hydrologic budget, Salinity, Nutrients, Evaporation, Mathematical models, Nutrient removal, Phosphorous, Water sampling, Calcium carbonate, Alkalinity, Chlorophyll, Nitrates, Ammonia, *Canton Atoll.

Budgets of water, salt, nutrients, carbon dioxide, suspended material, and sediments can be used to establish the dynamics of water exchange, biogeochemical reactions, and sedimentation in the Canton Atoll lagoon. Maximum water residence time in the lagoon is about 95 days. During that time, net evaporation raises the salinity nearly 4 parts per thousand above oceanic values. Phosphorus utilization in the lagoon is 0.027 mmole/sq m/day; nitrogen utilization is about 8.5 times this rate. Net excess organic carbon production is assumed to be 100 times the rate of phosphorus utilization (that is, about 3 mmole/sq m/day, or 36 mg C/sq m/day). Gross production, as inferred from gas exchange between the air and water, is 6 g C/sq m/day. CaCO3 production is 14 mmole/sq m/day, or 1.4 g CaCO3/sq m/day. Most of the CaCO3 produced in the lagoon remains there, but a substantial portion of the organic carbon produced is lost from the lagoon. Water motion is the parameter exerting major influence on the metabolism of the lagoon biotic community. Artificial alteration of water movement patterns has changed part of that community. Neither nitrogen nor phosphorus is likely to limit metabolism of the biota. CaCO3 production in the lagoon has probably been sufficient to fill the lagoon with about 20 m of sediment over the past 8,000 years. It is likely that the present episode of lagoon reef growth has been continuing for that timespan and that the CaCO3 production rate has decreased substantially over that period. (See also W79-06881) (Humphreys-ISWS)
W79-06883

REEF CORALS OF CANTON ATOLL: I. ZOOGEOGRAPHY,
Naval Undersea Center, Kailua, HI. Hawaii Lab.
J. E. Maragos, and P. L. Jokiel.
In: An Environmental Survey of Canton Atoll Lagoon, 1973. Final Report NUC TP 395, Naval Undersea Center, Hawaii Laboratory, Kailua, Hawaii, p 55-70, June 1976. 3 tab, 19 ref.

Descriptors: *Pacific Ocean, *Indian Ocean, *Atolls, *Geomorphology, *Reefs, *Surveys, On-site investigations, Tidal waters, Coral, Marine animals, Aquatic life, Data collections, *Phoenix Island, *Canton Atoll, Coral fauna, Hermatypic corals, Ahermatypic corals.

This paper described the hermatypic and ahermatypic corals collected at Canton Atoll in 1972 and 1973. Over 75 species and 36 genera and subgenera of reef corals were reported. When combined with the new records reported at McKean Atoll, these records nearly double the number of species and genera previously reported for the Phoenix Islands. Although the Phoenix Island coral fauna is considerably more diverse than previously estimated and more diverse than reported for island groups to the east, island groups to the west show much higher coral diversities. These findings are consistent with the overall trend, previously noted by Wells and others, of a decreasing number of coral species and genera from west to east across the tropical Pacific. Investigations also revealed that significant dissimilarities exist between the species and generic lists of Canton and adjacent islands and island groups in the Central Pacific. Although some of the apparent discontinuities in the distribution of certain corals may be artifacts resulting from variable or incomplete sampling, some are apparently real. The causes for the local suppression of certain genera and species from some islands and their abundance on others nearby are unknown but are probably related to geographic isolation or variations in the local rates of immigration and extinction of coral species. Comparison of the Phoenix data with previously reported coral distributions in the Indian Ocean seemed to support the theory that the Indo-Pacific reef coral fauna shows a homogenous distribution. (See also W79-06881) (Humphreys-ISWS)
W79-06884

REEF CORALS OF CANTON ATOLL: II. LOCAL DISTRIBUTION,
Naval Undersea Center, Kailua, HI. Hawaii Lab.
P. L. Jokiel, and J. E. Maragos.
In: An Environmental Survey of Canton Atoll Lagoon, 1973. Final Report NUC TP 395, Naval Undersea Center, Hawaii Laboratory, Kailua, Hawaii, p 71-97, June 1976. 7 fig, 10 tab, 18 ref.

Descriptors: *Surveys, *Atolls, *Reefs, *Geomorphology, Coral, Aquatic animals, Ecological distribution, On-site investigations, Spatial distribution, Water quality, Salinity, Tidal waters, Analysis, Analytical techniques, Data collections, Sediments, *Canton Atoll, Lagoon fauna.

Although undoubtedly of great importance as reef-formers, corals occupy only a few percent of the total bottom area at Canton Atoll. Distribution and abundance of the 77 reported species of reef corals at Canton appear to be controlled largely by biological interaction (that is, competition for space) at intermediate depths on the ocean reef slope and largely by physical factors (increased salinity, sedimentation, and turbidity; decreased water motion; and possibly available nutrients) in the lagoon. Coral coverage and number of species present in the lagoon decrease with increasing distance from the single passage where lagoon water exchanges with the open ocean. Canton is geographically isolated from atolls having extensive lagoon systems. Furthermore, exchange of lagoon water with the open ocean is confined to one passage along the atoll rim. Consequently, the lagoon fauna lacks 'exclusively lagoon' species of corals. Apparently the lagoon reefs have been colonized by a few of the abundant ocean-reef species. Widespread Indo-Pacific species belonging to the genera Pocillopora, Acropora, Montipora, and Millepora account for much of the coral coverage. In addition, several species uncommon elsewhere (including Hydnophora rigida and Halomitra philippinensis) account for an unusually large portion of the total coverage in some habitats. An abundance of fungiid species (8 genera and subgenera) is one of the most striking and unusual features of the coral fauna, along with an extensive lagoon line reef system dominated by Millepora. (See also W79-06881) (Humphreys-ISWS)
W79-06885

DISTRIBUTION OF INSHORE FISHES AT CANTON ATOLL,
Naval Undersea Center, Kailua, HI. Hawaii Lab.
J. G. Grovhoug, and R. S. Henderson.
In: An Environmental Survey of Canton Atoll Lagoon, 1973. Final Report NUC TP 395, Naval Undersea Center, Hawaii Laboratory, Kailua, Hawaii, p 99-157, June 1976. 7 fig, 2 tab, 15 ref, 1 append.

Descriptors: *Fish, *Surveys, *Atolls, *Aquatic animals, On-site investigations, Methodology, Reefs, Analysis, Saline water fish, Ecological distribution, Distribution patterns, Tidal waters, Data collections, *Canton Atoll, Fish fauna.

Inshore fishes at Canton were surveyed by visual sampling during a 2-week period in November and December 1973. Data from this survey expand the cumulative checklist for Canton Atoll fish species to 264 species from 50 families. The distribution of inshore fishes was analyzed from transect data, and 20 species were selected for representative distributional display. Several representative patterns of fish distribution emerge. Fish abundance (both individuals and species) is highest immediately outside and in the pass region. In the lagoon, abundance decreases with increasing distance from the pass. Fish transect and observational data were included in an appendix. (See also W79-06881) (Humphreys-ISWS)
W79-06886

MOLLUSCAN DISTRIBUTION PATTERNS AT CANTON ATOLL,
Naval Undersea Center, Kailua, HI. Hawaii Lab.
E. A. Kay.
In: An Environmental Survey of Canton Atoll Lagoon, 1973. Final Report NUC TP 395, Naval Undersea Center, Hawaii Laboratory, Kailua, Hawaii, p 159-169, June 1976. 4 fig, 2 tab, 4 ref.

Descriptors: *Mollusks, *Atolls, *Aquatic animals, *Surveys, Gastropods, Distribution patterns, Lagoons, Tidal waters, Reefs, Ecological distribution, Data collections, Sampling, Methodology, On-site investigations, *Canton Atoll, Bivalves.

Micromollusks in sediment samples from Canton Atoll were described in terms of 3 assemblages: seaward reef; outer, clear water lagoon; and inner, turbid water lagoon. The seaward reef and outer lagoon assemblages are characterized by low standing crops, high species diversity, and a preponderance of microherbivores, in contrast to the inner lagoon, where there are higher standing crops, lower species diversity, and a strong tendency toward suspension feeding. The dominant gastropods in the lagoon are members of the family Diastomidae, including Diala flammea and species of Obtortio and Scaliola. The dominant bivalves are cardiids. The assemblages at Canton resemble those from Fanning Atoll in general aspects, such as standing crops, species diversity, and trophic structure, but differ noticeably in species composition. Differences in species composition are suggested to be associated with differences in water chemistry. (See also W79-06881) (Humphreys-ISWS)
W79-06887

OBSERVATIONS ON TERRESTRIAL SURFACES AND SUBSURFACE WATER AS RELATED TO ISLAND MORPHOLOGY AT CANTON ATOLL,
Naval Undersea Center, Kailua, HI. Hawaii Lab.
E. B. Guinther.
In: An Environmental Survey of Canton Atoll Lagoon, 1973. Final Report NUC TP 395, Naval Undersea Center, Hawaii Laboratory, Kailua, Hawaii, p 171-183, June 1976. 2 fig, 2 tab, 4 ref.

Descriptors: *Surveys, *Water resources, *Atolls, Water quality, Geomorphology, Salinity, Water sampling, On-site investigations, Tidal waters, Tidal effects, Nutrients, Chlorophyll, Data collections, Groundwater, Lagoons, *Canton Atoll.

Reconnaissance sampling of isolated bodies of water on Canton Island revealed a pattern in salinities related to the physiography of the channels and flats of the island. Moderate salinities between 13 and 18 parts per thousand typified channelbed ponds, while lower salinities (less than 8 parts per thousand) typified potholes and water-filled burrows on the surrounding flats. Highest salinities (greater than 24 parts per thousand and up to 152 parts per thousand) were encountered in two larger ponds, in lagoon tidal channels, and in a saltern. A wide variation in concentration of nutri-

ents and chlorophyll a suggests ecological dissimilarities stemming either from salinity differences where such differences are great or from variations in biological community development owing to vagaries in colonization or previous environmental histories or both. (See also W79-06881) (Humphreys-ISWS)
W79-06888

TIME-STEPPING SCHEMES FOR FINITE ELEMENT TIDAL MODEL COMPUTATIONS,
Princeton Univ., NJ. Dept. of Civil Engineering.
W. G. Gray, and D. R. Lynch.
Advances in Water Resources, Vol. 1, No. 2, p 83-95, December 1977. 22 fig, 16 ref.

Descriptors: *Finite element analysis, *Tidal models, *Surface waters, Analytical techniques, Equations, Propagation factor.

A number of temporal procedures for solving the long-wave surface water equations using the finite element method in space are presented and analyzed. The analysis determines the stability of the schemes and the error in wave amplitude and phase that can be expected. The computational efficiency of the various methods is also discussed. The results of this analysis indicate types of errors that might be manifested in finite element surface water modeling using the different schemes. (Bell Graf-Cornell)
W79-06921

3. WATER SUPPLY AUGMENTATION AND CONSERVATION

3A. Saline Water Conversion

RESEARCH ON SALINE WATER CONVERSION BY FREEZING,
Massachusetts Inst. of Tech., Cambridge.
T. K. Sherwood, and P. L. T. Brian.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-197 790, Price codes: A05 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No 179, June 1966. 78 p, 27 fig, 5 tab, 29 ref. 14-01-0001-295.

Descriptors: *Desalination, *Desalination processes, *Freezing, Laminar flow, Membranes, Membrane processes, Crystal growth, Nucleation, Kinetics, Particle size, Additives, Ice-water interfaces, Saline water, Aqueous solutions, Diffusion, Flash freezing, Mass transfer, Heat transfer, Separation techniques, Water treatment, Water purification.

Progress in six areas of research on the desalination of aqueous solutions by freezing is summarized. The theoretical analysis of salt concentration build-up was extended to include laminar flow in round tubular membrane channels. It is concluded that for a reliable analysis it seems that the effluent concentration must be related to the membrane surface concentration. The study of the kinetics of ice crystal growth from supercooled water investigated whether small amounts of impurities added to the water altered growth kinetics. It was found that small concentrations of dissolved impurities in supercooled water do not greatly alter the kinetics of growth generally, but some concentrations of ammonium iodide and poly (acrylic acid) appear to reduce the growth velocity over the entire range of kinetics studied. The results and conclusions of previously published experimental work in washing brine from ice crystals are interpreted. The formation of ice crystal growth was studied in freezing saline water by direct contact with an immiscible refrigerant. An approximate theoretical analysis is presented for the influence of salt diffusion and of heat diffusion on the growth rate of ice crystals in undercooled saline water. Flash freezing of saline water and heat and mass transfer to small particles are two research programs still in their initial stages of development. (Davison-IPA)
W79-06570

MEMBRANE PHENOMENA,
Brooklyn Polytechnic Inst., NY.
H. P. Gregor.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-177 208, Price codes: A06 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No 193, May 1966. 101 p, 34 fig, 10 tab, 55 ref. 14-01-0001-319.

Descriptors: *Membranes, *Desalination, *Desalination apparatus, Permselective membranes, Films, Polymers, Plastics, Cation exchange, Anion exchange, Permeability, Diffusion, Electrolytes, Physical properties, Chemical properties, Laboratory tests, Porosity, Hydraulic properties, Water treatment, Separation techniques.

Detailed information on the specific properties of ion exchange membranes is presented. Various cation exchange membranes containing the sulfonic acid group were subjected to immersion tests; equilibrium and kinetic studies were made. Mean activity coefficients, diffusion coefficients, selectivity coefficients, the rate of anion exchange and the hydraulic permeability of these membranes were determined. An experimental cell was designed for work to determine polarization. The experimental results for the specific properties of cation exchange membranes and ACl anion exchange membranes are tabulated. Results are presented for diffusion coefficient of DHO in membranes, activity coefficients in polyelectrolytes, diffusion coefficients in polyelectrolytes, and hydraulic permeabilities of membranes. The theoretical discussion includes information on the calculation of pore diameters in cation exchange membranes, and calculation of electrodialytic polarization. (Davison-IPA)
W79-06571

DESALINATION BY ELECTROSORPTION AND DESORPTION,
Southern Research Inst., Birmingham, AL.
R. E. Lacey.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-210 527, Price codes: A03 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No. 195, June 1966. 77 p, 24 fig, 4 tab, 1 append. 14-01-0001-409.

Descriptors: *Desalination, *Desalination processes, *Desalination apparatus, *Electrosorption, Membranes, Membrane processes, Demineralization, Electric currents, Electrodialysis, Fabrication, Costs, Economics, Separation techniques, Water treatment, Water purification.

Desalination experiments were conducted with two prototype electrosorption stacks to determine the effects of current density, feed concentration, flow rate of solution, and spacing between electrosorption membranes on demineralization performance. It was shown that, at current densities less than the limiting value, the coulomb efficiencies obtained in the electrosorption process are as high as in electrodialysis, and resistances per cell pair are about 30% lower than in electrodialysis. When current densities exceed the limiting current density, pH-sensitive salts precipitate within the electrosorption membranes; these precipitates are removed during desorption. Methods for fabricating electrosorption membranes were studied, and work in developing these membranes is continuing. The theory and mathematical expressions for the demineralization and regeneration phases have been extended. Calculations based on previous experimental data indicate that although 15 to 25% of the electrosorption process operation time is spent in membrane regeneration, the energy costs are about the same as for electrodialysis when treating the same type of water. It is further indicated that the total cost of desalination by electrosorption should be lower than that for electrodialysis because of lower capital costs. (Davison-IPA)
W79-06572

RESEARCH ON MINERAL BY-PRODUCTS FROM SALINE WATERS,
Grace (W. R.) and Co., Clarksville, MD.
M. L. Salutsky, J. Block, and M. G. Dunseth.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-186 196, Price codes: A06 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No 197, September 1966. 177 p, 16 fig, 72 tab, 45 ref, 1 append. 14-01-0001-642.

Descriptors: *Desalination, *Pre-treatment(Water), *Phosphates, *Sulfates, *Potassium, *Economic feasibility, Sea water, Saline water, Water analysis, Water chemistry, Water treatment, Chemical precipitation, Chemical reactions, Separation techniques, Desalination plants.

Continuing research on the separation of mineral constituents from sea water and other saline waters is presented. Work is reported in the following areas: (1) recovery of potassium and sodium from saline waters by precipitation as a calcium double salt; (2) recovery of potassium from saline waters with iron and aluminum phosphate; (3) recovery of potassium from saline waters by precipitation with preformed magnesium ammonium phosphate; and (4) recovery of potassium from saline waters by precipitation with preformed magnesia alba. A process flowsheet for the recovery of potassium sulfate and sodium sulfates by calcium sulfate precipitation is provided. Cost estimates for this procedure show that a byproduct credit of $.20/1000 gallons of fresh water produced would be yielded from a 10 mgpd water conversion plant. The estimated manufacturing costs and byproduct values are tabulated. The price of chemical processing and the byproduct values are nearly the same for the recovery of potassium by the ferric phosphate process. (Davison-IPA)
W79-06573

STUDY AND ANALYSIS OF THE APPLICATION OF SALINE WATER CONVERSION PROCESSES TO ACID MINE WATERS,
Maryland Univ., College Park. Dept. of Chemical Engineering.
W. C. Schroeder, and J. M. Marchello.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-177 085, Price codes: A04 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No. 199, August 1966. 73 p, 11 tab, 23 ref. 14-01-0001-645.

Descriptors: *Desalination processes, *Acid mine water, *Water costs, *Capital costs, Operating costs, Ion exchange, Membrane processes, Distillation, Crystallization, Freezing, Effluents, Separation techniques, Water treatment, Waste water treatment, Water pollution treatment, Neutralization, Grassy Run(West Virginia), Kittanning Run(Pennsylvania).

An ion exchange process, two membrane processes, three crystallization and three distillation processes were examined to determine their potential application to acid mine waters. Water costs were determined for each process based on the total estimated capital and operating costs for various sized plants. Kittanning Run near Altoona, Pennsylvania, and Grassy Run near Elkins, West Virginia, were selected as feed to the plants. Except for ion exchange, all processes considered split the feed water into fresh water product and brine effluent which contains all the acid and iron present in the original feed water. Distillation, crystallization or the membrane processes can process acid mine water in its original condition or after it has been neutralized. The processing of acid water requires the use of more costly, acid resistant construction materials. Pre-treatment of the feed water by neutralizing it with sodium carbonate is favored for crystallization, membrane process, and distillation plants because of cost consideration. This neutralized water does not necessarily provide water suitable for domestic purposes. It is concluded that the saline water conversion processes considered would not be applicable to acid mine waters, except when a municipality's water supply needed augmentation with potable water meeting Public Health standards. (Davison-IPA)
W79-06574

DESIGN STUDY OF A REVERSE OSMOSIS PLANT FOR SEA WATER CONVERSION,
General Atomic Co., San Diego, CA.
D. T. Bray, and H. F. Menzel.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-176 288, Price codes: A06 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No. 176, April 1966. 98 p, 28 fig, 14 tab, 3 ref, 4 append. 14-01-0001-531.

Descriptors: *Desalination, *Desalination plants, *Desalination processes, *Desalination apparatus, *Reverse osmosis, Membranes, Pilot plants, Economics, Cost analysis, Estimated costs, Engineers estimates, Maintenance costs, Operating costs, Capital costs, Design criteria, Separation techniques, Water treatment, Water purification, Sea water, Brackish water.

As a first step in the engineering design of a reverse osmosis pilot plant, a parametric study of a one mgpd plant was undertaken to define system pressure, flow ratio between product water and brine stream, and the general flow arrangement suited for larger plant sizes. System parameters were selected on the basis of economic considerations allowed by the technical aspects, and the final selection criteria were the relative costs of water between the systems having different parameters. The costs were categorized as follows: annual capital charges, pumping power, operation and maintenance, and membrane replacement. Technical and economic ground rules and assumptions are discussed. The description of the one mgpd plant includes plant layout and system subassemblies. Capital and water costs for single and two stage operations are tabulated. The engineering design of a gpd pilot plant based on data from the parametric study is presented in Part 2. The plant is a single stage unit with a 50,000 gpd product water capacity, a 2160 psi system design pressure, and a 1.0 brine to product water flow ratio. The plant will require about 2400 modules containing six to seven sq ft of active membrane area arranged in series of 20 inside 120 coated carbon steel pipes. Drawings and schematic diagrams are included. (Davison-IPA)
W79-06575

FABRICATION AND EVALUATION OF NEW ULTRATHIN REVERSE OSMOSIS MEMBRANES,
Midwest Research Inst., Minneapolis, MN. North Star Research Div.
P. S. Francis.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-177 083, Price codes: A04 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No. 177, February 1966. 53 p, 14 fig, 14 tab, 16 ref. 14-01-0001-457.

Descriptors: *Desalination, *Desalination apparatus, *Ultrathin membranes, Fabrication, Laboratory testing, Polymers, Plastics, Distillation, Permeability, Semipermeable membranes, Separation techniques, Water treatment, Water purification.

Polymers with a broad range of chemical structures were used in devising methods to form ultrathin membranes. Membrane manipulation methods and testing procedures were developed which allowed a large number of flux and desalination measurements to be made on membranes of estimated thicknesses between 1400 and 5000 angstroms. Flux and desalination properties were determined for ultrathin polymeric membranes containing the following groups: ester, ether and acetal, nitrate ester, nitrile, urethane, chlorinated ether, aromatic and hydroxyl. Except for chlorinated polyether, all were permeated by water and rejected significant portions of salt. Annealing, solvent vapor exposure, membrane drying, and partial fractionation were investigated as treatments to increase membrane permeability or salt rejection. The results showed wide ranges of permeability and salt rejection, but as one property improved, the other suffered. Data obtained from infrared spectra of annealed and unannealed membranes and an X-ray pattern from a multilayered annealed cellulose acetate specimen are being analyzed. Results of these investigations indicate that the ultrathin membrane is a feasible approach for the study of film morphology and desalination mechanisms, and that the ultrathin membrane would be amenable to commercial production. (Davison-IPA)
W79-06576

RESEARCH ON SALINE WATER CONVERSION BY FREEZING AND REVERSE OSMOSIS,
Massachusets Inst. of Tech., Cambridge.
T. K. Sherwood, P. L. T. Brian, and A. F. Sarofim.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-177 205, Price codes: A05 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No. 180, May 1966. 85 p, 27 fig, 6 tab, 28 ref, 2 append. 14-01-0001-546.

Descriptors: *Desalination, *Desalination processes, *Reverse osmosis, *Freezing, Polarization, Mass transport, Membrane processes, Flow, Laminar flow, Turbulent flow, Nucleation, Crystal growth, Ice-water interfaces, Evaporation, Particle size, Light penetration, Separation techniques, Water treatment, Water purification.

Progress in seven areas of investigation is reported. Results of experimental studies of concentration polarization at a membrane surface in forward and reverse osmosis substantiate earlier theory and further clarify the understanding of the mechanism of salt and water transport through cellulose acetate membranes. Results of previously published theoretical analysis were used to present concentration polarization ratios for reverse osmosis systems operating at a variety of conditions including laminar and turbulent flow in tubular membranes. Progress in a preliminary study of the nucleation and growth of ice crystals in direct contact cooled brine with iso-butylene is summarized. Quantitative results have not yet been obtained in the investigation of the growth of ice across the surface of a pool of water subcooled by the continuous evaporation of water from the surface. The use of light transmission measurements to measure ice particle size and concentration is discussed. This technique is advantageous because it causes a minimum disturbance to the system studied, and the photocells provide an instantaneous record of the changes in particle size and concentration. The initial steps in establishing work on heat and mass transfer to small spheres in turbulent suspension are discussed. A proposed program for washing brine from ice crystals will be in two parts: experimental and theoretical. (Davison-IPA)
W79-06577

INVESTIGATION OF CALCIUM SULFATE PRECIPITATION,
Monsanto Research Corp., Everett, MA.
B. M. Fabuss, A. S. Borsanyi, and C. H. Lu.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-177 206, Price codes: A03 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No. 183, May 1966. 45 p, 17 fig, 8 tab, 3 ref. 14-01-0001-465.

Descriptors: *Chemical precipitation, *Calcium sulfate, *Solubility, *Laboratory tests, *Sealing, Fouling, Heat transfer, Equilibrium, Rates evaporation, Temperature, Laboratory equipment, Research and development, Separation techniques, Desalination, Desalination apparatus, Water treatment.

An investigation was undertaken to obtain basic information on the equilibria and rate processes controlling calcium sulfate precipitation which fouls heat transfer surfaces in many desalination processes. Constant volume heating and constant temperature evaporation experiments were conducted by precipitating calcium sulfate from distilled water. The laboratory equipment consisted of an autoclave, sampling filter system, condenser and receivers, and associated instrumentation. The concentration range in the volume heating experiments was 400 to 2000 ppm with an equilibrium temperature range of 90 to 155C. A temperature range of 80 to 180C with initial concentrations of 100 to 1020 ppm and an evaporation ratio of 2.3 to 4.1 were used in the constant temperature evaporation experiments. In both types of experiments a break point was observed in the conductivity versus temperature curve at constant concentration, or in the conductivity versus concentration curve at constant temperature. These break points occurred between the solubility curves of the hemihydrate and anhydrite modifications. Precipitation started after the break point; the concentration of the solution did not reach or exceed solubility values corresponding to the hemihydrate solubility curve. For the temperature range, 100 to 180C, the precipitation of calcium sulfate from distilled water was controlled by the solubility curve of anhydrite; precipitation with respect to anhydrite was slow process. (Davison-IPA)
W79-06578

DESIGN AND CONSTRUCTION OF A DESALINATION PILOT PLANT, (A REVERSE OSMOSIS PROCESS).
Aerojet-General Corp., Azusa, CA.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-181 574, Price codes: A04 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No. 86, January 1964. 61 p, 19 fig, 2 append. 14-01-0001-296.

Descriptors: *Desalination, *Desalination processes, *Reverse osmosis, *Laboratory equipment, *Membranes, *Fabrication, Evaluation, Laboratory tests, Adhesives, Sodium chloride, Aqueous solutions, Corrosion, Desalination apparatus, Separation techniques, Water treatment, Water purification, Sea water, Brackish water, Pilot plants.

A 1000 gpd pilot plant was designed, fabricated, and assembled in an evaluation of the reverse osmosis process for desalination of brackish and sea water. Membrane fabrication techniques and equipment are described. Of the two techniques used to evaluate the membranes, the dye test was rejected on the basis of the equipment and time involved; a random sampling and testing of 10% of a day's membrane production has been used with good results. Feed water compositions of 0.5%, 1.5% and 3.5% sodium chloride were used in operating tests. In many tests operation was continuous for four days at constant operating conditions. A total of 1100 gallons of product containing less than 400 ppm dissolved solids was produced during one 24 hours test with a 0.5% sodium chloride solution. Preliminary attempts to reduce corrosion, which had become an operating problem, were partially successful. The design of the bench scale appratus followed the laboratory equipment as closely as possible, but included novel features not used in the laboratory. Several different designs for desalination cells and membrane configurations were fabricated and tested on this apparatus. The results of this work indicate that some of the concepts will yield a more economical cell design. (Davison-IPA)
W79-06579

FIRST ANNUAL REPORT: SALINE WATER DEMONSTRATION PLANT NO. 2, SAN DIEGO, CALIFORNIA.
Burns and Roe, Inc., Hempstead, NY.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-181 684, Price codes: A10 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No. 102, February 1964. 194 p, 48 fig, 20 tab, 7 append. 14-01-0001-233.

Descriptors: *Desalination, *Desalination plants, *Demonstration Plant No 2, *Flash distillation, *Desalination processes, *Costs, Capital costs, Operating costs, Water costs, Maintenance costs, Water quality, Separation techniques, Water treatment, Scaling, Corrosion, Vegetation effects, Marine plants, Tubes, Water purification, San Diego(California), Sea water.

Group 3A—Saline Water Conversion

A technical and operational evaluation of the flash distillation process as employed by Demonstration Plant No. 2 at San Diego, California is reported for the period March 1962 through June 1963. During the first year of operation, mechanical difficulties caused only the normal interruption expected in new plants. Plant downtime was principally caused by clogging of the intake screens, condenser tubes, and tube sheets by marine vegetation. Some success was achieved through modifications to the equipment, but stoppage due to clogging remains the critical problem. Raising the distillation temperature increased the plant production, and although less corrosion and scaling were found than expected at the higher temperatures, the length of time in service was too short for these observations to be significant. During the period 347,000,000 gallons of high quality fresh water containing 5 ppm of dissolved solids have been delivered to the city of San Diego. Demonstration plant capital, operating, and maintenance costs are tabulated, and theoretical costs for a normalized plant are discussed. Although the major problems of scaling and high temperature operation have been overcome, long-term corrosion rates for the various types of metal tubing have not been determined. The copper alloy and carbon steel tubes appear in good condition. It is concluded that large scale plants of this type are economically attractive. Schematic drawings of the plant are provided. (Davison-IPA)
W79-06580

SEPARATIONS PROCESSES,
Oak Ridge National Lab., TN.
J. S. Johnson, Jr., and K. A. Kraus.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-200 921, Price codes: A11 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No 508, February 1970. 231 p, 90 fig, 22 tab, 481 ref. 14-01-0001-937.

Descriptors: *Desalination, *Desalination processes, *Filtration, *Reverse osmosis, *Membrane processes, Membranes, Boundary layers, Polarity, Ion exchange, Mass transport, Adsorption, Heat transfer, Separation techniques, Water treatment, Water purification, Desalination apparatus.

Work on transport through membranes and across phase boundaries, and on ion exchange is reported in the third volume of the second biennial report on the activities of the Water Research Program at Oak Ridge National Laboratory. Altogether 21 papers are presented covering the following areas: salt filtration by charged microporous solids; hyperfiltration (reverse osmosis); concentration polarization; boundary layer studies; detachable membranes; dynamically formed membranes; and ion exchange. Of the 14 articles published in the open literature, one, 'Review Article on Hyperfiltration' has appeared as a chapter in the book 'Principles of Desalination'. There are 290 references for this article. (Davison-IPA)
W79-06581

SECOND ANNUAL REPORT, BRACKISH WATER CONVERSION DEMONSTRATION PLANT NO. 4 ROSWELL, NEW MEXICO.
American Hydrotherm Corp., New York.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-193 147, Price codes: A09 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No. 170, May 1966. 184 p, 45 fig, 22 tab, 23 ref, 7 append. 14-01-001-322.

Descriptors: *Desalination, *Desalination plants, *Demonstration Plant No 4, *Forced circulation vapor compression distillation, Capital costs, Operating costs, Operation and maintenance, Evaporators, Distillation, Scaling, Ion exchange, Equipment, Brackish water, Roswell(New Mexico).

A technical evaluation of the maintenance and repair work done and the development work carried out at the Roswell vapor compression distillation plant, New Mexico, is reported for July 1, 1964 through June 30, 1965. The plant was in actual operation only 21.3% of the scheduled time and produced 53.5 million gallons, averaging 750,000 gpd. Repairs and maintenance were necessary on all equipment. The compressor and its motor accounted for 50% of the downtime; major reconstruction of the ion exchange system was required. Developmental work was carried out on the ion exchange system, the deaeration system, and the evaporator system. The evaporator system studies related to velocity distribution, concentration studies of blowdown and the concentration that should provide scale free operation (3:1); scale composition at 4:1 concentration; additives for scale prevention; and the flow rate of the circulating pumps. Demonstration plant capital and operating costs, and theoretical capital and operating costs for a normalized plant are presented in addition to monthly production and cost figures. It is concluded that the plant is capable of producing one million gallons/day; that it is capable of scale free operation at a concentration factor of 3 to 1; and that its ion exchange system is capable of working mostly with blowdown introducing only a small amount of purchased salt. (Davison-IPA)
W79-06582

A STUDY OF REVERSE OSMOSIS SYSTEMS FOR DESALINATION,
Syracuse Univ., NY.
W. N. Gill, C. Tien, and D. W. Zeh.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-177 207, Price codes: A03 in paper copy, A01 in microfiche. OSW Research and Development Progress Report No 185, May 1966. 33 p, 10 fig, 2 tab, 7 ref. 14-01-0001-401.

Descriptors: *Desalination, *Desalination processes, *Reverse osmosis, Flow, Performance, Diffusion, Equations, Boundary layers, Pressure, Velocity, Separation techniques, Water treatment, Water purification.

Continuous constant pressure reverse osmosis two-dimensional flow systems are analyzed, so that system performance is predicted in terms of operating variables. Therefore, the solution of the nonlinear diffusion equation employs nonlinear boundary conditions, and a series solution, accounting for nonlinearities in both the diffusion equation and its boundary conditions, is developed. Only wedge type flows are considered for boundary layer flows with pressure gradient, and the analysis is applicable to fully developed flows and entrance region flows. Numerical results are generalized, and some specific data are reported for systems similar to those used in practice. (Davison-IPA)
W79-06583

DESIGN AND SPECIFICATION BID PACKAGE FOR A 2500 GPD EUTECTIC FREEZING PILOT PLANT.
Fluor Engineers and Constructors, Inc. Irvine, CA.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-295 916, Price codes: A08 in paper copy, A01 in microfiche. Report, March 1979. 127 p, 3 drawings. OWRT C-80132-S(8518)(1). 14-34-0001-8518.

Descriptors: *Freezing process, Thermal process, *Desalination, Brine.

A technical specification bid package for a 2500 gallon per day (GPD) eutectic freeze pilot plant was prepared. The package includes process and mechanical flow diagrams and plot plan of the pilot plant, as well as general project information and specific design criteria for the plant. The eutectic freezing pilot plant is designed to desalinate a brine feedwater, by producing ice and salt. A brine solution is fed into the freezer tank from which heat removal is accomplished by direct contact evaporation of refrigerant, R-114. Solids, ice and dihydrate salt, and a eutectic solution of brine are produced. A hydrocyclone is used to separate the heavier salt from the ice. Solid salt is removed from the brine solution in a filter. Ice is removed from the brine solution in drain and wash columns. Ice from the top of the wash column is repulped with product water to form a slurry which is fed to the melter/condenser. The ice is melted to form product water and in turn the compressed R-114 vapors from the freezing tank are condensed. Because of process inefficiencies and heat leaks into the process, the quantity of ice produced is not sufficient to condense all the refrigerant vapors. Make-up refrigerant is provided with a packaged refrigeration unit.
W79-06858

FINAL REPORT TO OFFICE OF WATER RESEARCH AND TECHNOLOGY - CONTRACT NO. 14-34-0001-7513.
Membrane Systems, Inc., San Diego, CA.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-296 046, Price codes: A04 in paper copy, A01 in microfiche. February 1979. 55 p, 10 fig, 8 tab. OWRT (7513)(1). 14-34-0001-7513(1).

Descriptors: *Low pressure membrane, *Composite membrane, Brackish water, Spiral wound elements, Desalination processes, Reverse osmosis, Membranes processes.

In Phase I, low pressure, composite membrane was developed for the desalination of brackish waters. The membrane barrier layer was formed by the interfacial polycondensation of polyethyleneimine and isophthaloyl chloride on polysulfone porous support. The polysulfone porous support was cast on a non-woven polyester fabric. The membrane has a flux of 20-22 GFD and a rejection of 97% or better when operated on a feedwater at 250 PSIG containing 5,000 mg/l of sodium chloride at 75F. In Phase II, 6 spiral wound reverse osmosis elements with nominal dimensions of 2 inches in diameter and 12 inches in length were fabricated, tested and shipped to the Roswell Test Facility. In Phase III, 6 spiral wound reverse osmosis elements with nominal dimensions of 4 inches in diameter and 12 inches in length were fabricated, tested and shipped to the Roswell Test Facility.
W79-06891

3B. Water Yield Improvement

THE DEVELOPMENT OF ORGANIC ICE NUCLEI GENERATORS FOR WEATHER MODIFICATION,
Denver Research Inst., CO. Cloud Physics Lab.
For primary bibliographic entry see Field 2B.
W79-06765

POTENTIAL FOR AUGMENTING FLOW OF THE COLORADO RIVER BY VEGETATION MANAGEMENT,
Rocky Mountain Forest and Range Experiment Station, Tempe, AZ.
A. R. Hibbert.
In: Proceedings, 21st Annual Arizona Watershed Symposium, Nov. 1, 1977, Tucson, Arizona, Arizona Water Commission Report No. 10, p 16-21, (1977). 5 tab.

Descriptors: *Colorado River Basin, *Vegetation effects, *Flow augmentation, *Watershed management, *Water yield improvement, *Forest management, *Evapotranspiration control, Rainfall-runoff relationships, Snow management, Water conservation, Environmental effects, Evaporation control, Sublimation, Streamflow, Surface runoff, Clear-cutting, Cost analysis, Streamflow forecasting.

Building on the acknowledged premise that streamflow in the Colorado River Basin will be insufficient to meet all future demands anticipated from rapid growth in the region and the requirements of energy development, this study seeks to set forth some theoretical watershed management practices that might reduce evaporative loss and thus increase water yield in the Basin. Water yield response to various treatment practices was determined for 11 vegetation types (excluding phreatophytes) on lands in all ownerships in both Upper and Lower Basins, occupying some 76 million acres, or one-half the total Basin. Results of such

trials indicate that one-half million acre-feet of extra water could be obtained from the Upper Basin by committing up to 22% of each vegetation type except aspen forest by 80-year rotation clear-cut harvest in patches; in the Lower Basin, more extensive treatments would be required to generate a quarter of a million acre-feet of extra water. Disregarded in these choices are knowledge of availability of treatable acreage and economic feasibility, whereas in actual practice economic factors will strongly influence priorities of treatment, as will the complex and difficult matter of public acceptance of water yield improvement theories. (Paylore-Arizona)
W79-06833

FORMATION FINES AND FACTORS CONTROLLING THEIR MOVEMENT IN POROUS MEDIA,
Exxon Production Research Co., Houston, TX.
For primary bibliographic entry see Field 2F.
W79-06864

3C. Use Of Water Of Impaired Quality

EVAPOTRANSPIRATION BED DESIGN,
Goodson (Raymond L.) Inc., Dallas, TX.
For primary bibliographic entry see Field 2D.
W79-06748

CONTROLLED DEGRADATION AND/OR PROTECTION ZONES--NONSENSE,
Science and Education Administration, Phoenix, AZ. Water Conservation Lab.
For primary bibliographic entry see Field 5G.
W79-06902

3E. Conservation In Industry

RECYCLING OF WATER IN POULTRY PROCESSING PLANTS,
Stanford Research Inst., Menlo Park, CA.
C. J. Rogers.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-280 720, Price codes: A03 in paper copy, A01 in microfiche. Interim Technical Report No. EPA-600/2-78-039, March 1978. 38 p, 6 fig, 12 tab, 1 append. S-800930.

Descriptors: *Water reuse, *Water pollution treatment, *Waste water treatment, *Food processing industry, *Poultry, *Recirculated water, Water conservation, Waste water(Pollution), Microorganisms, Light, Ultraviolet radiation, Water quality control, Filtration, Filters, Diatomaceous earth, Operating costs, Cost comparisons, Bacteria, Effluents, Refrigeration, Water cooling, Solid wastes, Chlorides, Coliforms, Activated carbon, Centrifugation, Biochemical oxygen demand.

Results are reported of pilot scale studies on treating water for recycle in the chiller used in poultry processing. To ensure a sanitary product, the USDA requires a half gallon of water/bird in the chiller system. A recycling system for maintaining equivalent water quality at reduced flow must be capable of removing solids and controlling microbial population. For ultraviolet light, used to control the microbial population, to be effective sufficient solids must be removed to allow light transmission. The removal methods studied include: (1) cyclonic desludgers, (2) vibrating screens, (3) flotation cells, (4) centrifugal waste concentration, (5) filtration with diatomaceous earth (DE) filter aid, and (6) activated carbon. Results showed that DE filtration was most feasible and that it maintained bacterial level equivalent to that in a comparable nonrecycle system. New water requirements/bird are reduced from 0.5 gallons to 0.2 gallons. Operating costs for the DE filtration system using 30 gallons of ice/minute are $79.06/day. Operating cost of the chiller without recycle are $146.90/day. (Davison-IPA)
W79-06953

3F. Conservation In Agriculture

POWER TRANSMISSION FOR SELF-PROPELLED IRRIGATION SYSTEM,
Toro Co., San Marcos, CA. (Assignee).
E. J. Hunter, and R. E. Hunter.
U.S. Patent No. 4,133,344, 7 p, 7 fig, 9 ref; Official Gazette of the United States Patent Office, Vol 978, no 2, p 474, January 9, 1979.

Descriptors: *Patents, *Irrigation, *Irrigation systems, *Irrigation practices, *Irrigation efficiency, Application equipment, Center pivot irrigation system, Transmission, Self-propelled equipment.

A self-propelled center pivot irrigation system has individual span units each one of which has at least one or more fluid conduits, and at least one or more power frames for propelling the span unit. Each power frame has at least one or more drive wheels, a drive motor, and transmission means connecting the drive motor to the drive wheels. The transmission has an input drive gear, intermediate planetary gear speed reduction means and an output shaft for connection between the drive motor output shaft and the power frame drive wheels to provide a low friction, speed reducing, torque increasing drive for the power frame drive wheels from the drive motor. (Sinha-OEIS)
W79-06630

IRRIGATION LINE MOVER,
Crown American Irrigation, Inc., Eugene, OR. (Assignee).
P. E. Batson.
U.S. Patent No. 4,134,422, 5 p, 6 fig, 10 ref; Official Gazette of the United States Patent Office, Vol. 978, No. 3, p 845, January 16, 1979.

Descriptors: *Patents, *Irrigation, *Irrigation systems, *Irrigation efficiency, Irrigation practices, Pipes, Application equipment, Mechanical equipment, Line mover.

An improved irrigation line mover is disclosed in which a line mover carried an engine rotating an irrigation pipe supported by wheels keyed to the pipe. The engine also drives wheels of a cart-like carriage of the line mover through reversible one-way clutches. Each clutch includes a sprocket keyed to an axle keyed to cart wheels and a lever-like pawl held by a spring extending around the axle in either an only forward driving position relative to the sprocket or an only reverse driving position relative to the sprocket. (Sinha-OEIS)
W79-06635

LIQUID FLOW CONTROL DEVICE,
E. M. Bright.
U.S. Patent No. 4,134,550, 9 p, 9 fig, 6 ref; Official Gazette of the United States Patent Office, Vol 978, No 3, p 891, January 16, 1979.

Descriptors: *Patents, *Irrigation, *Irrigation efficiency, *Irrigation practices, *Flow control, Application equipment, Valves, Water pressure, Drip irrigation, Emitters.

A low cost valve, such as an emitter for controlling the flow from an aperture in a drip irrigation pipe, operates dynamically to maintain flow substantially constant across a wide range of pressures. A cylindrical valve seat mounted within the pipe aperture receives a valve member having a coaxial stem portion that extends through the valve seat to couple an external cap member. The interior end of the valve member comprises a diverging cone defined by integral and circumferentially separated leaf elements that engage a bearing surface of the valve seat at a root circumference when unstressed. Increasing water pressure within the pipe acts against the interior of the cone surface, distorting the leaf elements inwardly a proportional amount and shifting the valve member relative to the bearing surface through a selected limited operating range. The effective apertures between the leaf elements increase in length but decrease in width with greater pressure, providing an increasing impedance that maintains flow rate constant. The leaf elements are of selected stiffness and of relatively low friction material, and assume a stable pressure responsive position whether pressure is increasing or decreasing. The apertures between the leaf members are further shaped to provide an automatic purging flow when the pressure increases to or above a selected maximum. (Sinha-OEIS)
W79-06636

EMITTER FOR DRIP IRRIGATION,
D. G. Zeman.
U.S. Patent No 4,134,551, 8 p, 7 fig, 5 ref; Official Gazette of the United States Patent Office, Vol 978, No 3, p 891, January 16, 1979.

Descriptors: *Patents, *Irrigation, *Irrigation efficiency, Irrigation practices, Flow control, Application equipment, Tubes, Closed conduits, Drip irrigation, Emitters.

A desirable emitter for use in drip irrigation can be constructed so as to utilize an elongated member formed of a flexible, resilient material so as to include at least one and preferably a number of internal ribs or projections which prevent the interior of the member from being closed off or pinched shut as it is deformed or flexed. Such a member is normally mounted so as to extend into an enclosed space such as the interior of an irrigation tube or conduit in such a manner that water can flow from the interior to the exterior of the space through the member. The liquid within the space can be controlled so as to exert a force against the exterior of the emitter causing it to be deformed or flexed in such a manner as to vary the flow through the member. (Sinha-OEIS)
W79-06637

WATER BALANCE IN IRRIGATED SOILS,
Academia de Stiinte Agricole si Silvice, Bucharest (Romania).
M. Botzan, and O. Merculiev.
ICID Bulletin (International Commission on Irrigation and Drainage), Vol. 27, No. 2, p 23-29, 35, July, 1978. 26 ref.

Descriptors: *Water balance, Irrigation design, Irrigation programs, *Consumptive use, Soil-water-plant relationships, Leaching, Evapotranspiration.

The paper presented the results obtained by land experimental research works carried out in different pedoclimatic zones of Romania (temperate zone) between 1945-1947 and continuously since 1951. The water balance elements (initial reserve, final reserve, winter and summer precipitations, groundwater supply, soil water consumption on different calculated probabilities on crops and pedoclimatic zones, the water application and the irrigation rates during the vegetation and supply periods) were quantitatively characterized. Interrelationships of water consumption with the type of crop and pedoclimatic zone, soil humidity, air temperature, and crop yield were established. These correlations allowed for establishing an indirect water-consumption calculation method. For the irrigation project designing model, the basic elements and the limitative conditions were established. Both the irrigation as required and irrigation by rotation were analyzed for the water application forecast and programming. Also, the basic participating elements of the model in the prognosis stage were established together with the limitative conditions which determine the water application program in the row of plots irrigated in a single rotation. (Skogerboe-Colorado State)
W79-06647

DESCRIBING IRRIGATION EFFICIENCY AND UNIFORMITY.
American Society of Civil Engineers, New York. Irrigation and Drainage Div.
Journal of the Irrigation and Drainage Division, Proceedings of the American Society of Civil Engineers, Vol 104, No IR1, p 35-41, March 1978. 3 fig, 6 equ, 11 ref.

Descriptors: *Irrigation efficiency, *Water distribution(Applied), *Surface irrigation, *Uniformity, Sprinkler irrigation, Trickle irrigation, Soil moisture, Equations, Mass balance, Infiltration, Depth.

To help standardize system design and evaluation terminology, a limited number of the more essential terms defining efficiency of water application and distribution by irrigation systems are presented. These definitions have been formulated to minimize conflict with common usage or existing glossaries. Where methods of evaluating the terms are not obvious, suggestions have been presented and the utility of the terms in irrigation system design or evaluation has been discussed. Application of the terms to some of the newly developing methods of irrigation has also been considered. (Bell-Graf--Cornell)
W79-06648

TRICKLE IRRIGATION UNIFORMITY AND EFFICIENCY,
Rain Bird Technical Services, Glendora, CA.
K. Solomon, and J. Keller.
Journal of the Irrigation and Drainage Division, Proceedings of the American Society of Civil Engineers, Vol 104, No IR3, p 293-306, September 1978. 5 fig, 1 tab, 16 equ, 8 ref.

Descriptors: *Irrigation efficiency, *Trickle irrigation, *Application methods, *Emission standards, *Uniformity, Design, Networks, Histograms, Flow rate, Manifolds, Equations, Pressure distribution, Effects, Sloping terrain.

Expressions are developed and presented for the pressure head available at any point within a trickle irrigation subunit. Histograms are drawn showing the distributions of pressure within typical subunits. Distributions of emitter flow rates within typical subunits are derived from considerations of the effects of pressure differentials and manufacturing variations in emitter characteristics. The coefficient of equations and distributions developed are used to complete tables giving the emission uniformity and efficiency of systems for various combinations of design and equipment characteristics. (Bell-Graf--Cornell)
W79-06649

LEACHING CONTROL CAN'T BE PERFECT,
R. Larsen.
Irrigation Age, Vol. 13, No. 2, p. 49, October, 1978. 1 fig.

Descriptors: *Leaching, Leachate, *Nitrogen, Nitrates, Irrigation, Scheduling, Nebraska.

This article reported the study to minimize losses from leaching conducted on sandy soils by some members of the Agricultural Engineering Department, University of Nebraska-Lincoln. The major conclusion of the study was that scheduling of irrigations to minimize percolation and proper selection of nitrogen (N) amount and source can have a significant effect on nitrate leaching loss when corn is produced on sandy soils. The study, however, indicated that reducing the loss to zero is not a practical goal on sandy soils. (Skogerboe-Colorado State)
W79-06696

REMOTE SENSING FOR AGRICULTURAL WATER MANAGEMENT AND CROP YIELD PREDICTION,
Science and Education Administration, Phoenix, AZ. Water Conservation Lab.
S. B. Idso, R. D. Jackson, and R. J. Reginato.
Agricultural Water Management, Vol. 1, No. 4, p 299-310, December, 1978. 5 fig, 32 ref.

Descriptors: *Remote sensing, Water management(Applied), Crop production, Scheduling, Irrigation, Albedo, Soil moisture, Evaporation.

This paper reviewed the research conducted at the U.S. Water Conservation Laboratory, Phoenix, Arizona over the past several years relative to agricultural application of remote sensing. In addition, new data were presented. The subjects treated were soil moisture, evaporation, irrigation scheduling, and crop yield estimation. The analyses indicated that the technology is available to successfully integrate remote sensing techniques into agricultural operations designed to enhance production via intelligent water management. (Skogerboe-Colorado State)
W79-06698

MINIMIZING SALT IN DRAIN WATER BY IRRIGATION MANAGEMENT--DESIGN AND INITIAL RESULTS OF ARIZONA FIELD STUDIES,
Science and Education Administration, Riverside, CA. Salinity Lab.
G. J. Hoffman, C. Dirksen, R. D. Ingvalson, E. V. Maas, and J. D. Oster.
Agricultural Water Management, Vol. 1, No. 3, p 233-252, November, 1978. 11 fig, 3 tab, 19 ref.

Descriptors: Water management(Applied), *Salinity, *Drainage water, *Leaching, Return flow, Evapotranspiration, Oranges, Alfalfa, Arizona.

Two field experiments were established in the Wellton-Mohawk Irrigation and Drainage District of southwestern Arizona to test the feasibility of decreasing the salt load in drainage water by reduced leaching. Results were given for the initial 2 years of the test for Valencia orange trees and the first year for alfalfa. The water application data, substantiated by salinity sensor readings and measures of soil chloride, indicated that the annual evapotranspiration of Valencia orange was approximately 1375 mm on a total area basis. After 2 years, fruit yield and quality and tree growth were not significantly different from flood-irrigated trees that received 40% more water. It was concluded that if these results persist, the salt load from citrus in the district could be reduced 40,000 Mg annually by reduced leaching. More importantly, because of the salinity of the groundwater pumped for water table control the salt load exported from the district could be reduced initially by 130,000 Mg annually. Results indicate that the alfalfa experiment was underirrigated the first year and evapotranspiration was about 1950 mm annually. Comparisons indicated that the level basin flood irrigated check yielded 20% more than the experiment and had about 10% leaching, an efficiency that can probably not be improved. (Skogerboe-Colorado State)
W79-06700

LEARNING TO IRRIGATE...WITH 5000 TENSIOMETERS,
C. Henry.
Irrigation Age, Vol 13, No 3, p 6-8, November-December, 1978. 4 fig.

Descriptors: Tensiometers, *Irrigation scheduling, Idaho.

This article reports the experience of an irrigation consultant with the use of tensiometers for irrigation scheduling. (Skogerboe-Colorado State)
W79-06701

CHEMICAL INJECTION POPULAR IN NORTHWEST,
C. Henry.
Irrigation Age, Vol 13, No 3, p 46-47, November-December, 1978. 3 fig.

Descriptors: *Irrigation, *Fertilizers, Fertilization, Chemicals, Sprinkler irrigation, Application methods, Application equipment, Injection.

This article reports and discusses the methods and benefits of applying liquid chemicals and fertilizers with irrigation water. (Skogerboe-Colorado State)
W79-06702

BEST USE OF CROP RESIDUES,
Nebraska Univ., Lincoln. Dept. of Agronomy.
C. R. Fenster, R. H. Follett, and E. J. Williamson.
Crops and Soils Magazine, Vol 30, No 9, p 10-13, August-September, 1978. 3 fig, 2 tab.

Descriptors: Feeds, Crops, *Organic matter, Soil erosion.

Present and some potential uses of crop residues are described. The best use of crop residues depends on the crop, the soil, the location, and a number of other problems directly and remotely related to agriculture. (Skogerboe-Colorado State)
W79-06704

CHOICES IN IRRIGATION MANAGEMENT,
ICID Bulletin, (International Commission on Irrigation and Drainage). Vol. 27, No. 2, p 62-64, July, 1978.

Descriptors: Groundwater, *Irrigation programs, Pricing, Crop production.

A workshop on choices in irrigation management was organized by the Agricultural Administration Unit of the Overseas Development Institute and held at the University of Kent, Canterbury. The workshop was attended by 35 participants, of whom 12 came from eight different countries in Asia, Africa and Latin America. The majority of these had extensive first-hand experience of irrigation management at project level. Twenty-one papers were presented and discussed. This paper is a summary of these 21 papers discussed under several categories of irrigation management. (Skogerboe-Colorado State)
W79-06710

SOME PROPOSITIONS ABOUT IRRIGATION PROJECT AND SYSTEM MANAGEMENT,
Overseas Development Inst., London (England).
A. F. Bottrall.
ICID Bulletin, International Commission on Irrigation and Drainage. Vol. 27, No. 2, p 68-72, July, 1978. 1 tab.

Descriptors: *Irrigation programs, Agriculture, Decision making, Project planning, Crop production.

This is a modified version of a paper presented at the Overseas Development Institute Workshop on Choices in Irrigation Management, held from 27 September-1 October, 1976 at the University of Kent, Canterbury, (U.K.). The object of this paper is to put forward some generalized propositions about certain aspects of irrigation management in developing countries on which, whatever the characteristics of a particular project or system may be, strategic decisions will at some point have to be made. The propositions are concerned primarily with projects dependent on surface water delivery systems. The propositions are derived primarily from observations made during field research in North West India and from the desk review of case studies in other parts of the developing world. The first set of propositions is concerned with the broader aspects of project organization and management, the second set with more detailed aspects of water delivery system design and operations. But there is clearly a large degree of interdependence between propositions in each set. (Skogerboe-Colorado State)
W79-06711

WATER BALANCE OF FLOODED RICE PADDIES,
Texas A and M Univ., College Station. Dept. of Soil and Crop Sciences.
For primary bibliographic entry see Field 2I.
W79-06713

HARVESTING RUNOFF FROM PRECIPITATION ON IRRIGATED LANDS,
Kansas Water Resources Research Inst., Manhattan.
For primary bibliographic entry see Field 4A.
W79-06734

A SOIL-WATER-NITROGEN MODEL FOR IRRIGATED CORN ON SANDY SOILS,
Nebraska Univ., Lincoln. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 2K.
W79-06736

WATER HARVESTING AGRISYSTEM TO GROW JOJOBA ON DEVELOPED IDLE FARMLAND,
Arizona Water Resource Research Center, Tucson; and Arizona Univ., Tucson. Office of Arid Lands Studies.
C. B. Cluff, and K. E. Foster.
Arizona Water Resources News Bulletin, No. 78-1, 2, Jan.-April 1978. 3 fig, 2 tab.

Descriptors: *Water harvesting, *Rainfall-runoff relationships, *Water yield improvement, *Jojoba, *Surface sealing, Arid climtes, Water conservation, Sodium Chloride, Weed control, Reservoir storage, Computer analysis, Root zone, Infiltration, Agricultural production, Crop response, Arizona.

Recognizing the present groundwater overdraft of most of Arizona's basins, the University of Arizona Water Resources Research Center in cooperation with the Dept. of Soils, Water and Engineering, has developed a water harvesting agrisystem to rehabilitate abandoned farmland, designed to operate without groundwater. For descriptive purposes the system is applied to jojoba as a cash crop on a 40-acre area in the Avra Valley, Arizona. Based upon a similar system at Page Ranch, north of Tucson, where a one-acre plot has been used for the past several years to grow grapes, the present project involves the reshaping of farmland into a ridge and runoff configuration which is treated with sodium chloride to increase runoff and reduce weed and dust control costs. Rainwater is expected to run from the ridged portion into adjacent drainages planted with jojoba, with excess runoff being collected and pumped to a compartmented reservoir for plant use as needed during peak-production low-precipitation periods. The system design parameters were tested by computer analysis based upon 31 years of daily rainfall and runoff records of the test area. Three simulations were made using different root-depth and infiltration-width data. Results indicated that as jojoba plants grow, larger amounts of water can be stored in the soil and lesser amounts in the compartmented reservoir although the reservoir appears to be essential to maximize production. Estimated costs to estabish and maintain one plantation acre of jojoba for the three years before bean yield are $1,638 per acre. (Tickes-Arizona)
W79-06846

REDUCING SALT PICKUP FROM IRRIGATED LANDS,
Colorado State Univ., Fort Collins. Dept. of Agricultural and Chemical Engineering.
W. R. Walker, G. V. Skogerboe, and R. G. Evans.
Journal of the Irrigation and Drainage Division, Proceedings of the American Society of Civil Engineers, Vol. 105, No. IR1, p 1-14, March 1979. 5 fig, 16 ref.

Descriptors: *Irrigation efficiency, *Automation, *Salinity, *Water quality control, *Optimization, *Cost minimization, *Model studies, Colorado River, Desalination, Return flow, Seepage, Drainage, Furrow irrigation, Sprinkler irrigation, Trickle irrigation, Equations, Systems analysis, Agriculture, Treatment model, Canal linings, Cost effectiveness.

Reducing the contribution of irrigated agriculture to the problem of salt loading in a major river basin is described in both a conceptual and mathematical context. The array of alternative solutions are primarily structural in nature and are oriented towards reducing salt pickup resulting from inefficient irrigation practices. The optimization of salinity control strategies involves combining the best features of several control measures. Consequently, the analyses described are based on finding the minimum cost solution to a salinity control problem involving a specified goal for salt load reduction. The multilevel optimization method involves two models: (1) an agricultural model divided into a water conveyance subsystem and an on-farm subsystem; and (2) a treatment model. (Bell Graf-Cornell)
W79-06937

AIR CHAMBERS FOR IRRIGATION SYSTEMS,
Bookman and Edmonston, Glendale, CA.
G. E. Conant, and D. E. Jaspar.
Journal of the Transportation Engineering Journal, Proceedings of the American Society of Civil Engineers, Vol. 105, No. TE2, p 141-148, March 1979. 4 fig, 2 tab, 1 ref.

Descriptors: *Irrigation systems, *Air chambers, *California, *Droughts, *Water distribution(Applied), *Wells, *Water hammer, *Pipelines, Agriculture, Groundwater, Irrigation, Hydraulics, Hydrodynamics, Pumping.

The 1977 drought was the most severe in California's history. The California Water Project was able to deliver only about 30% of the water demands for the calendar year 1977. The Wheeler Ridge-Maricopa Water Storage District receives its water from the California Water Project and, therefore, the District was able to provide only 30% of the farmer's water needs in 1977. The District, in an effort to alleviate the effects of the drought, allowed private wells to be connected into the District's distribution system. The existing distribution systems were not designed to accommodate such connections and the resulting hydraulic pressures within the distribution system were of concern to the District. In view of the need for additional water, a simple conservative solution to the problem of analysis employs the techniques presented by Parmakian. Confirmation of the validity of the solutions is supported by field tests. (Bell Graf-Cornell)
W79-06939

4. WATER QUANTITY MANAGEMENT AND CONTROL

4A. Control Of Water On The Surface

FLOOD HAZARD INFORMATION: ANIMAS RIVER AND JUNCTION AND DRY GULCH CREEKS, DURANGO, COLORADO.
Army Engineer District, Sacramento, CA.
For primary bibliographic entry see Field 2E.
W79-06532

FLOOD HAZARD INFORMATION: COLORADO RIVER, PALISADE, COLORADO.
Army Engineer District, Sacramento, CA.
For primary bibliographic entry see Field 2E.
W79-06533

THE EFFECT OF CERCOSPORA RODMANII, A BIOLOGICAL CONTROL FOR WATERHYACINTH ON THE FISH, GAMBUSIA AFFINIS,
Florida Univ., Gainesville. Dept. of Plant Pathology.
K. E. Conway, and R. E. Cullen.
Mycopathologia, Vol 66, No 1-2, p 113-116, 1978. 3 tab, 5 ref. OWRT A-033-FLA(7). 14-34-0001-8010.

Descriptors: *Biocontrol, Aquatic weeds, Plant pathogens, Pathogenic fungi, *Water hyacinth, Cercospora rodmanii.

The effect of Cercospora rodmanii, a fungal pathogen being developed as a biological control for waterhyacinth, was evaluated on Gambusia affinis in a standard 96-hour bioassay. Testing indicated that C. rodmanii had no adverse effects on treated fish and would not be a hazard to populations of these fish in nature. (Heaney-Florida)
W79-06558

RAIN WATER MANAGEMENT FOR LOWLAND RICE CULTIVATION IN INDIA,
Central Soil Salinity Research Inst., Karnal (India). Div. of Engineering.
V. V. D. Narayana.
Journal of the Irrigation and Drainage Division, American Society of Civil Engineering, Vol. 105, No. IR1, Proceedings Paper 14430, p 87-98, March 1979. 12 fig, 7 tab, 9 ref, 1 append.

Descriptors: *Rainfall, *Storage, *Alkaline soils, Runoff, Hydrographs, Infiltration, Hydraulic conductivity, Ponds, Water resources, Crops, Rice, Precipitation(Atmospheric), On-site investigations, Water management(Applied), Agriculture, Hydrology, *India.

In India, only a small portion of the total rainfall is utilized for crop production; the rest runs off. Nearly 2,500,000 ha of alkali soils of the Indo-Gangetic region (characterized by flat topography and impermeable nature) remain unproductive due to surface water stagnation during the rainy season. The Central Soil Salinity Research Institute at Karnal, India, worked out design criteria and specifications for a three-tier system of rainwater management for these areas and hydrologically evaluated their performance. It was demonstrated that by adopting this rainwater management procedure, water use efficiencies were increased, drainage needs minimized, and groundwater recharge increased. (Sims-ISWS)
W79-06604

LEACHING CONTROL CAN'T BE PERFECT,
For primary bibliographic entry see Field 3F.
W79-06696

TO MARK SAMPLING EVENTS ON A RUNOFF HYDROGRAPH,
Maryland Univ., College Park. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 7B.
W79-06697

PENN STATE RUNOFF MODEL TO PINPOINT FLOOD-PRODUCING SUBAREAS,
Pennsylvania State Univ., University Park. Dept. of Civil Engineering.
G. Aron, and D. F. Lakatos.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-295 751, Price codes: A03 in paper copy, A01 in microfiche. Paper presented at ASCE Conference. Aug. 4-7, 1976, Purdue Univ., IN. 35 p, 11 ref 3 fig, 1 tab. Water Resources Journal. OWRT B-076-PA (3), 14-0001-5108.

Descriptors: Planning, Computer models, *Storm runoff, Surface runoff, Urbanization, Floods, Urban drainage, Urban hydrology, Urban runoff, *Model studies.

Successful urban water resources management depends on the ability of urban planners and managers to predict accurately, in advance, the effects that increased urban development will have on stormwater runoff. The present inability to predict watershed response is a major factor leading to increased urban flooding, and a lowering of runoff quality due to the lack of proper control. The situations for which the use of the Penn State Urban Runoff Model is intended are less general than those of many current urban runoff models. The Penn State Urban Runoff Model was developed as an alternative to the traditional Rational Method and other semi-empirical procedures for urban drainage design. It deals entirely with the quantity of stormwater runoff, and does not directly consider urban runoff quality. The objectives adopted for the development of the Penn State Urban Runoff Model were: (1) to produce an urban runoff simulation model which would provide acceptable hydraulic accuracy while remaining at a level of sophistication compatible with minimum practice and data collection time, (2) to

keep the model as simple and concise as possible to insure its convenient use, (3) to allow for the analysis of the timing of subarea flow contributions to peak rates at various points in a watershed. (Sink-Penn State)
W79-06730

SIZING TAILWATER RECOVERY SYSTEMS TO UTILIZE RUNOFF FROM PRECIPITATION ON IRRIGATED LANDS,
Kansas State Univ., Manhattan. Dept. of Agricultural Engineering.
Mao Liang-Tsi.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-295 817, Price codes: A05 in paper copy, A01 in microfiche. MS Thesis 1977, 88 p, 11 fig, 12 tab, 19 ref, 2 append. OWRT A-077-KAN (2).

Descriptors: Furrow irrigation, Storage volume, *Runoff, *Irrigated land, Precipitation, Tailwater.

Runoff from precipitation on furrow irrigated land is considered as an alternative source of irrigation water in Western Kansas. This helps to prolong the life of ground water supplies. A continuous watershed simulation model was used to estimate the amount of runoff generated from field-size furrow irrigated areas. The runoff was then routed through various sizes of tailwater recovery pits to determine the amounts of runoff utilized, based on continuous pumping systems. Pit size is the main factor affecting the percentage of runoff utilized. When the storage volume of the pit increases to 5 times the normal tailwater recovery pit size, about 70 percent of the runoff from precipitation was utilized. This is up to 10 percent of the total water used for irrigation. The quantity of ground water used decreases as the quantity of runoff utilized increases. Both of these terms can be expressed in a second-order polynomial equation. The sum of all the costs affected by the use of runoff from precipitation determines the optimum pit size. The factors which determine the optimum pit size are quantity of runoff availiable to be utilized, pumping lifts of well and pit, type of fuel used, and fuel price. If the fuel price and well pumping lift rise above a certain level, it might become economically feasible to construct a larger pit to utilize runoff from irrigated land.
W79-06733

HARVESTING RUNOFF FROM PRECIPITATION ON IRRIGATED LANDS,
Kansas Water Resources Research Inst., Manhattan.
H. L. Manges, and Liang-Tsi Mao.
Paper No. 78-2559, Presented at 1978 Winter Meeting, American Society of Agricultural Engineers, Chicago, Illinois, December 18-20, 1978. 15 p, 2 fig, 3 tab, 10 ref, ASAE, St. Joseph, Michigan. OWRT A-077-KAN(3).

Descriptors: Tailwater, *Irrigated land, *Runoff, Precipitation, Water balance, Pumping.

Runoff from precipitation on irrigated land is an alternate source of water for irrigation. Use of such water can extend the life of ground water presently stored in underground aquifers. A tailwater management model was developed to simulate runoff from furrow irrigated land. Runoff volume from precipitation was estimated and routed to various sizes of tailwater pits. A daily water balance was maintained for both the soil and the pit. The tailwater management model was tested for corn growing on two commonly irrigated soil types on a quarter section of land near Garden City, Kansas. Twenty five years of continuous records of climatological data were used to simulate performance of the system. The tailwater pit was sized to hold multiples of one day's pumping for irrigation. Average annual precipitation was 473 millimeters and runoff from precipitation was 69 and 39 millimeters for Soil Types 3 and 5, respectively. Runoff from precipitation pumped back onto the field varied from 26 percent when the pit held runoff from one day's irrigation to 70 percent for a pit 5 times as large. Runoff from precipitation pumped from the tailwater pit was 3 and 7 percent of total water pumped for Soil Type 3, and 2 and 4 percent for Soil Type 5, respectively, with the smaller percentage pumped from the smaller pit.
W79-06734

A DRAINAGE MODEL FOR A RECLAIMED SURFACE MINE,
Iowa State Univ., Ames. Dept. of Agronomy.
L. Prunty, and D. Kirkham.
Soil Science Society of America Journal, Vol. 43, No. 1, p 28-34, January-February 1979. 9 fig, 1 tab, 15 ref.

Descriptors: *Mathematical models, *Mine drainage, *Strip mines, *Land reclamation, Crops, Steady flow, Water table, Terracing, Dupuit-Forchheimer theory, Soil profiles, Drains, Depth, Groundwater recharge, Hydraulic conductivity, Model studies, Row crops, Bench terraces.

Strip mine reclamation for row-crop production employing bench-terraced geometry is under study and may become increasingly common. A simplified model of the postreclamation soil profile at the Iowa Coal Project Demonstration Mine No. 1 was created. The model was used to find the steady-state water-table shape if one tube drain per terrace is installed. Dupuit-Forchheimer (D.F.) theory was used for the anayses. Water-table curves were generated for a series of alternative drain-tube locations. An analysis was made to find the best position for the drain tube. It was found that, for a recharge-to-soil-conductivity ratio of 0.01 for terraces repeating at a 45.7-m interval, the best drain-tube location is beneath the horizontal portion of the terrace 4.87 m from the toe of the backslope if the drain tubes are placed 2.44 m beneath the surface of soil underlaid by a barrier at 3.05 m depth. The horizontal portion of the bench terraces is 38.08 m, and the vertical drop from one terrace to the next is 3.05 m. A table of best drain locations was given for other drain depths and recharge rates. Previous work on D.F. theory for a uniformly sloped barrier was discussed briefly and compared with and contrasted to the present work for a barrier that parallels the bench-terraced surface of the reclaimed surface mine. (Visocky-ISWS)
W79-06743

THE USE OF LANDSAT DCS AND IMAGERY IN RESERVOIR MANAGEMENT AND OPERATION,
Army Engineer District, Waltham, MA. New England Div.
S. Cooper.
Type II Progress Report No 6, September 1, 1976. 13 p, 5 fig, 1 tab. NASA 22510.

Descriptors: *Remote sensing, *Satellites(Artificial), *Snow cover, *Watersheds(Basins), Instrumentation, Equipment, Water resources, Reservoirs, Reservoir operation, Snowpacks, Computers, Computer programs, Projects, *LANDSAT.

New England Division's LANDSAT downlink has been fully implemented, and the tracking system operates unattended with near 100% reliability. Software has been developed with the intention of the recovery from various malfunctions. Power interruptions do not abort the data collection function entirely, but if a satellite pass is in progress when a power failure occurs, the remainder of data from the current pass will be lost; however, the computer will recoup by the next pass. The LANDSAT tracking system integrates a set of about 20 programs or subroutines, about 10 disc data files, and several pieces of equipment. Essentially, the system predicts the satellite position, tracks the satellite, stores the incoming data, returns to the predicting program, and continues cycling in that fashion. Initial analysis of the 4 MSS energy band computer printouts showed that the greatest contrast between the areas of snow on open spaces, such as rivers and fields, and forested areas occurred on MSS band 5 (0.6-0.7 micrometers). (See also W77-02151) (Sims-ISWS)
W79-06762

RUNOFF EVALUATION OF CATCHMENTS AT GRANITE REEF,
Science and Education Administration, Phoenix, AZ. Water Conservation Lab.
D. H. Fink, G. W. Frasier, and L. E. Myers.
In: Proceedings, 21st Annual Arizona Watershed Symposium, Nov. 1, 1977, Tucson Arizona, Arizona Water Commission Report No. 10, p 26-32 (1977), 8 fig, 2 tab, 8 ref.

Descriptors: *Water harvesting, *Rainfall-runoff relationships, *Runoff, *Water yield improvement, *Surface sealing, Water conservation, Surface-runoff, Water spreading, Infiltration, Soil compaction, Soil sealants, Soil treatment, Costs, Vegetation effects, Membrane processes, Regression analysis, Asphalt, Plastics, Synthetic rubber, Arizona.

Described is a water harvesting research program conducted by the U. S. Water Conservation Laboratory, Phoenix, AZ, carried out at the Granite Reef test facility near Mesa, AZ. Laboratory and limited field studies commenced in 1959 with the intention of establishing and developing the most promising water harvesting materials and treatments. To evaluate treatments at Granite Reef, measurement of runoff efficienties for individual storms for extended periods of time was undertaken using linear regressional analysis. Results indicated that asphalt-fiberglass treatments yield nearly as much runoff per year as membrane sheetings like butyl rubber and polyethylene, and will outlast butyl under Arizona conditions, while being considerably less expensive to install. Paraffin wax treatments yielded nearly as well as butyl, showed no signs of weathering after 5 years and were even less expensive to install than asphalt-fiberglass. Other treatments that were evaluated were standard roofing, concrete, silicone and devegetation, smoothing and compaction, all of which were found to be less efficient in varying degrees at increasing runoff. (Tickes-Arizona)
W79-06832

COUNTY DRAINAGE DITCHES IN SOUTH CENTRAL MINNESOTA: A UNIQUE RIPARIAN ECOSYSTEM,
Mankato State Univ., MN. Dept. of Biology.
H. W. Quade.
In: Strategies for Protection and Management of Floodplain Wetlands and Other Riparian Ecosystems, GTR-WO-12. Proceedings of the Symposium, Callaway Gardens, Georgia, December 11-13, 1978, p 400-410. 5 fig, 5 tab, 10 ref. A-040-MINN(1).

Descriptors: *Drainage, *Drainage area, *Drainage effects, *Drainage practices, *Drainage programs, *Drainage systems, Minnesota, Lake Tetonka, Le Sueur County, Agricultural runoff, Farm wastes, Agricultural chemicals, Environmental effects, Land reclamation, Land management, Water quality, Water pollution sources, Legal aspects, Permits, Mapping.

Research is reported for the purpose of generating input data which will eventually allow a model of the drainage system in South Central Minnesota to be made. The extent and reasons for drainage in this area are addressed, and the findings of a case study on the effects of a drainage ditch on lake nutrient loading are reviewed. The constitutionality of drainage within Minnesota is also discussed. According to a 1959 agricultural census Minnesota had drained 11.7 acres of land representing 11.5% of all drained agricultural land in the U. S. An extensive mapping program of the drainage in this area, initiated because existing data was not dependable, becomes important, because significant differences in the extent of drainage data would result in differences in water resource planning by county, State or Federal planners. Water quality samples taken at several locations revealed that the major loading of Lake Tetonka in Le Sueur County comes from the Cannon River upstream of the confluence of the river and County Ditch 59. The water chemistry from a variety of ditches is being investigated. It is concluded that construction and maintenance of drainage ditches should follow the broadly based, environmentally assessed guidelines, and that it is possible for Minnesota to

have both quality agriculture and water resources. (Davison-IPA)
W79-06876

OPTIMAL WEEKLY RELEASES FROM A SEASONAL RESERVOIR 1. DETERMINISTIC FUTURE,
Electro-Watt Engineering Service Ltd., Zurich (Switzerland).
F. Laufer, and H. J. Morel-Seytoux.
Water Resources Research, Vol. 15, No. 2, p 383-398, April 1979. 15 fig, 4 tab, 22 ref.

Descriptors: *Reservoir releases, *Reservoir operation, *Optimization, *Hydrology, *Power economics, *Decision theory, *Operations research, Equations, Drawdown, Constraints, Runoff, Rivers, Water policy, Reservoir storage, Algorithms, Seasonal, Weekly, Electrical energy, Kuhn-Tucker conditions, Refill, Alpine watersheds, Lagrange multipliers, Finite capacity, Emptiness, Benefit maximization.

A technique is presented to maximize the returns from the operation of a seasonal alpine reservoir for the production of electrical energy. The emphasis rests on a comprehensive approach to the problem, and the following fields are considered: hydrology, power economics, operations research, and decision theory. The solution technique to determine the optimal releases strategy is first developed for the deterministic case. It is based on the solution of the system of equations given by the Kuhn-Tucker conditions. As the direct solution of this system of equations is complicated, an alternative approach has been devised. The operation period is divided into two parts: the drawdown phase and the refill phase. For each phase, the optimality conditions are solved by a procedure akin to Masse's constrained calculus of variations, the physical constraints being first ignored, and then introduced in a stepwise manner. A preliminary study of the approximate nature of the optimal releases sequence provides a good starting point in the variational procedure and the number of iterations necessary to arrive at the optimum is reduced to a minimum. The application of the developed technique to a seasonal reservoir fed by an alpine watershed shows that the method is both feasible and attractive. It is also well suited for generalization to the case of an uncertain future, to be presented in a second paper. (Bell Graf-Cornell)
W79-06919

A COMPARISON OF THREE FLOODING REGIMES, ATCHAFALAYA BASIN, LOUISIANA,
Coastal Environments, Inc., Baton Rouge, LA.
J. L. van Beek, K. Wicker, and B. Small.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-293 157, Price codes: A05 in paper copy, A01 in microfiche. Final Report No. EPA-600/3-78-106, December 1978. 90 p, 24 fig, 19 tab, 13 ref, 1 append. 68-01-2299.

Descriptors: *Flood plains, *Regime, *Backwater, *Regional development, *Planning, *Atchafalaya River Basin(Louisiana), Sediment discharge, Water levels, Rainfall, Fluctuations, Bayous, Flood control, River flow, Runoff, Watershed management, Bayou Fordoche, Buffalo Cove, Pat Bay.

A study of three backwater areas of the Atchafalaya Basin was undertaken to compare the hydrologic regime of sub-basins differing from each other with respect to mode of flooding, stage variation, relative contribution of atchafalaya River water and local runoff, and type of environment. Fordoche and Buffalo Cove located within the Atchafalaya Basin Floodway and subject to annual flooding by the River, and Pat Bay located outside the floodway and in which flooding is controlled by local rainfall were selected for study. The comparison revealed the following as the most urgent need for management of Atchafalaya Basin Floodway units: (1) induction of low discharge flowthrough to enhance water exchange in those areas currently subject to a backwater regime and insufficiently dewatered; (2) reduction of inflow associated with short term water level fluctuations during the annual rise of the River stages to reduce sediment introduction; (3) maximum utilization of the unit's surplus precipitation as a source of flood water to reduce inflow of Atchafalaya River water and sediments; and (4) the realization of these needs through water introduction at the upper end of the unit and simultaneous control over outflow at the lower end of the unit. (Davison-IPA)
W79-06943

4B. Groundwater Management

A PLANNING STUDY FOR IRRIGATION DEVELOPMENT IN WASHINGTON. VOLUME I, EXECUTIVE SUMMARY.
Washington State Univ., Pullman. Dept. of Agricultural Economics.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-274 550, Price codes: A03 in paper copy, A01 in microfiche. Prepared for Washington State House of Representatives, Olympia, October 1976. 48 p.

Descriptors: *Water resources, *Water rights, *Irrigation, *Water requirements, *Irrigation effects, *Washington, Water use, Water costs, Social costs, Marketing, Economic feasibility, Hydroelectricity, Energy, Columbia Basin Project, Equity, Public benefits.

This report summarizes the findings of an in-depth study of irrigation in Washington State. The report considers: (1) the employment and population changes induced by irrigation development; (2) employment and income effects of irrigation development; (3) energy and irrigation in Washington; (4) social overhead capital costs of irrigation development; (5) marketing of irrigation products; (6) economic potentials for producing and processing high valued cash crops from new irrigated lands in Washington; (7) economic feasibility of irrigation development; and)(8) water use fee. The opportunities and result in net migration into the area. Land owners, some farmers, food processors and the transportation industry are among those who benefit from irrigation development. Even the general public will benefit from improved aesthetics, more recreational opportunities, and lower food costs. But there are costs involved when building large-scale irrigation projects in Washington. Large-scale diversions create large losses of hydroelectric generating capability whose costs are borne by power consumers and social overhead costs paid by the general public in the form of higher state and local taxes, higher rates for utilities, and higher costs for services such as waste disposal. The analysis of irrigation feasibility shows that little or no profit can be expected from irrigation development in the state at this time. The report concludes that the evidence points in favor of a water use fee, which would offset the cost of transferring water resources belonging to all to individuals for their private use. (Coan-NC)
W79-06544

U.N. GROUND WATER PROGRAM.
For primary bibliographic entry see Field 9B.
W79-06707

ANALYTICAL STUDY OF THE OGALLALA AQUIFER IN GAINES COUNTY, TEXAS, PROJECTIONS OF SATURATED THICKNESS, VOLUME OF WATER IN STORAGE, PUMPAGE RATES, PUMPING LIFTS, AND WELL YIELDS,
Texas Dept. of Water Resources, Austin.
For primary bibliographic entry see Field 7C.
W79-06738

EVAPOTRANSPIRATION BED DESIGN,
Goodson (Raymond L.) Inc., Dallas, TX.
For primary bibliographic entry see Field 2D.
W79-06748

THAT SINKING FEELING.
For primary bibliographic entry see Field 2F.
W79-06804

THE EFFECTS OF THE 1975-76 DROUGHT ON GROUNDWATER AND AQUIFERS,
Institute of Geological Sciences, London (England). Dept. of Hydrogeology.
For primary bibliographic entry see Field 2E.
W79-06807

THE HEALTH EFFECTS OF GROUND WATER RECHARGE. PART I,
National Water Well Association, Worthington, OH.
For primary bibliographic entry see Field 5C.
W79-06895

THE HEALTH EFFECTS OF GROUND WATER RECHARGE: PART II,
National Water Well Association, Worthington, OH.
For primary bibliographic entry see Field 5G.
W79-06896

THE 208 PLANNING APPROACH TO GROUND WATER PROTECTION - A FOOT IN THE DOOR,
Illinois Environmental Protection Agency, Springfield.
For primary bibliographic entry see Field 5G.
W79-06905

THE 208 PLANNING APPROACH TO GROUND-WATER PROTECTION - A PROGRAM OVERVIEW,
Environmental Protection Agency, Washington, DC. Water Planning Div.
For primary bibliographic entry see Field 5G.
W79-06906

GROUND-WATER COMPUTER MODELS - PRACTICAL TOOLS,
Wright Water Engineers, Inc., Denver, CO. Ground Water Div.
For primary bibliographic entry see Field 7C.
W79-06908

4C. Effects On Water Of Man's Non-Water Activities

THE WATER BUDGET AND POTENTIAL WATER RESERVES OF THE EAST AFRICA SOURCE REGION OF THE NILE,
McGill Univ., Montreal (Quebec). Dept. of Meteorology.
For primary bibliographic entry see Field 2A.
W79-06591

HYDROLOGIC IMPACTS OF SILVICULTURAL ACTIVITIES,
Rocky Mountain Forest and Range Experiment Station, Fort Collins, CO.
C. A. Troendle.
Journal of the Irrigation and Drainage Division, American Society of Civil Engineers, Vol. 105, No. IR1, Proceedings Paper 14437, p 57-70, March 1979. 9 fig, 4 tab, 6 ref, 1 append.

Descriptors: *Forestry, *Forest management, *Forest watersheds, *Water pollution sources, Water pollution, Forests, Trees, Model studies, Mathematical models, Precipitation(Atmospheric), Runoff, Evapotranspiration, Streamflow, Watersheds(Basins), Mountains, Soil moisture, Hydrology.

Most pollution associated with silvicultural activities has a nonpoint source and is difficult to control by conventional methods. Process-oriented techniques were developed to allow the planner, engineer, or hydrologist to evaluate the impact that any proposed silvicultural activity will have on the hydrology of the planning unit. Changes in the

hydrologic processes stimulate changes in non-point source pollution. As a part of the effort to quantify hydrologic impacts, the country was broken into 5 hydrologic regions. Hydrologic models were fitted to representative baseline watersheds in each region. Process stimulation was then used to develop response coefficients to be used to modify the regional baseline levels of evapotranspiration (ET), soil water, and streamflow as a function of cover, soil depth, aspect, latitude, and position in the watershed. This presentation summarized the results of the efforts and presented an evaluation of the usefulness of the methodology. (Sims-ISWS)
W79-06606

A PLANNING ALGORITHM TO ASSESS THE IMPACT OF URBAN GROWTH ON FLOOD EXPECTANCY,
Colorado State Univ., Fort Collins. Coll. of Forestry and Natural Resources.
For primary bibliographic entry see Field 2E.
W79-06726

EXTERNALITIES FROM URBAN GROWTH: THE CASE OF INCREASED STORM RUNOFF AND FLOODING,
Iowa Univ., Iowa City. Inst. for Economic Research.
For primary bibliographic entry see Field 2E.
W79-06727

DISTRIBUTED ROUTING RAINFALL-RUNOFF MODEL,
Geological Survey, NSTL Station, MS. Water Resources Div.; National Weather Service, Silver Spring, MD. Hydrologic Sciences Div.; and Geological Survey, Reston, VA. Water Resources Div.
For primary bibliographic entry see Field 6A.
W79-06830

4D. Watershed Protection

EFFECT OF CHISEL VERSUS MOLDBOARD PLOWING ON SOIL EROSION BY WATER,
Science and Education Administration, Lafayette, IN. Soil, Water and Air Sciences.
C. B. Johnson, and W. C. Moldenhauer.
Soil Science Society of America Journal, Vol. 43, No. 1, p 177-179, January-February 1979. 3 tab, 3 ref.

Descriptors: *Soil erosion, *Erosion control, *Farm management, Erosion, Simulated rainfall, Runoff, Infiltration, Farms, Crops, Soils, Soil science, Agriculture, Plowing, Plowing practices, Moldboard plowing, Chisel plowing, Residues.

An experiment was conducted using simulated rainfall on a field that was chisel plowed annually for 13 years before the experiment to compare erosion from this condition with moldboard plowing in the same field. One treatment was fall moldboard plowed, a second fall chiselled with some residue left on the surface, and a third was untilled in the fall with all residue removed in the spring. All 3 treatments were disked lightly in the spring. After the initial experiment was completed, residue was added so that all treatments had about 20% surface cover. During the initial rain application with no residue added, soil losses from the third treatment without surface residue were the same as those from the chisel plowed and disked surface with some surface residue. Both these treatments had only 23% of the soil loss of the moldboard plowed and disked treatment. During succeeding simulated rainfall under wet and very wet soil conditions, soil loss from the disked only treatment was up to 80% of that for the moldboard-plowed treatment. When residue was added to all treatments, soil loss from the chisel-plowed treatment was less than one-half that from the moldboard-plowed treatment. (Sims-ISWS)
W79-06695

5. WATER QUALITY MANAGEMENT AND PROTECTION

5A. Identification Of Pollutants

NEW APPROACHES TO THE PRESERVATION OF CONTAMINANTS IN WATER SAMPLES,
Syracuse Research Corp., NY. Center for Chemical Hazard Assessment.
J. Saxena, and E. Nies.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-293 013, Price codes: A04 in paper copy, A01 in microfiche. Report EPA-600/4-79-007, 1979. 58 p, 11 fig, 6 tab, 61 ref.

Descriptors: *Preservation, *Sampling, *Nutrients, *Biochemical oxygen demand, *Oil, Microorganisms, Phosphorus, Nitrogen, Hydrogen ion concentration, Freshwater, *Stabilization.

The use of antibiotics, chemical biocides, and lytic enzymes to preserve nitrogen and phosphorus series of nutrients, biological oxygen demand, and oil and grease in water and wastewater samples, was investigated. Sample preservation was evaluated based on ability to inhibit cell growth and oxygen utilization in primary and secondary effluents and natural water samples. Drugs which exhibited potential were: chlorohexidine, vantocil IB, polymyxin B + neomycin + streptomycin (PNS), erythromycin + polymyxin B + neomycin (EPN), erythromycin + polymyxin B + streptomycin (EPS), polymyxin B + chloramphernical + neomycin (PCN) and gentamycin + amikacin + polymyxin B (GAP). For primary effluents, the effective concentration range was 100 - 200 micrograms/ml. Effective concentrations were 50 - 100 micrograms/ml for secondary effluents and 10 - 50 micrograms/ml for fresh waters. Chlorhexidine and vantocil IB stabilized nitrate and nitrite in fresh water and relatively clean secondary effluent. The antimicrobial agents did not offer a practical solution to the preservation of BOD in waste waters. Oil and grease levels were stabilized by GAP and PCN for up to two weeks in fresh water. Chlorhexidine and vantocil IB effectively stabilized pH and dissolved oxygen in natural water samples only. (Small-FIRL)
W79-06545

STORM RUNOFF MICROBIOLOGY ADDS TO CONCERNS,
Ontario Ministry of the Environment, Rexdale.
For primary bibliographic entry see Field 5B.
W79-06590

FACTORS IN THE DETERMINATION OF SELECTED TRACE ELEMENTS IN NEARSHORE U.S. WATERS OF LAKES SUPERIOR AND HURON,
Environmental Research Lab., Duluth, MN.
J. E. Poldoski, E. N. Leonard, J. T. Fiandt, L. E. Anderson, and G. F. Olson.
Journal of Great Lakes Research, Vol 4, No 2, p 206-215, June 1978. 10 tab, 29 ref.

Descriptors: *Trace elements, *Lake Superior, *Lake Huron, *Great Lakes, Sampling, Chemicals, Chemical analysis, Chromium, Copper, Iron, Manganese, Nickel, Lead, Mercury, Lakes, Surveys, On-site investigations, Water pollution, Pollutants, Pollutant identification, Arsenic, Near-shore waters.

Determinations of total As, Cr, Cu, Fe, Mn, and Pb in acidified unfiltered water samples from 48 stations representing the nearshore waters of Lake Superior, Lake Huron, and selected incoming streams gave overall mean concentrations and standard deviations (microgram/L) of 1.0 + or - 0.7, 0.9 + or - 1.8, 2.0 + or - 1.8, 236 + or - 819, 14 + or - 34, and 0.7 + or - 0.8, respectively, using flameless atomic absorption analytical methods. Total concentrations of Ni and Hg were usually less than the instrumental detection limits (microgram/L) of 0.8 and 0.02, respectively. Small losses of Hg, As, and Cr from solutions are possible in addition to a molecular spectral interference in the determination of As using the graphite furnace method. River waters usually were only slightly higher in total element concentrations than lake waters, except for Fe and Mn. Nearshore waters of both lakes were very similar in elemental composition. (Sims-ISWS)
W79-06597

IDENTIFICATION OF CONTAMINANTS IN LAKE SUPERIOR THROUGH LANDSAT 1 DATA,
Minnesota Univ.-Duluth. Dept. of Physics.
M. Sydor, K. R. Stortz, and W. R. Swain.
Journal of Great Lakes Research, Vol. 4, No. 2, p 142-148, June 1978. 7 fig, 2 tab, 14 ref. NASA NGL-24-005263, EPA R005286011.

Descriptors: *Remote sensing, *Great Lakes, *Pollutants, *Lake Superior, Satellites(Artificial), Turbidity, Suspended solids, Clays, Mine wastes, Erosion, Sediments, Particle size, Rivers, Lakes, Runoff, Pollutant identification, Water pollution, Water pollution sources, Limnology, LANDSAT.

Remote sensing signatures were developed for using LANDSAT data in identification of 4 types of particulate contaminants in Lake Superior. The criteria were based on the residual LANDSAT signal intensities and signal ratios. The signatures worked well in differentiation of river runoff from high background turbidity due to erosion and resuspension. The threshold concentrations for identification of suspended solids in lakes ranged on the order of 1 mg/L for clear lakes such as Lake Superior and 5 mg/L for light absorbing water characteristic of the Duluth-Superior Harbor. (Sims-ISWS)
W79-06600

STATISTICAL ANALYSIS OF THE 1975 INTERCOMPARISON STUDY ON LAKE ERIE,
Ohio State Univ., Columbus, Dept. of Statistics.
For primary bibliographic entry see Field 2H.
W79-06601

EFFECTS OF SEWAGE SLUDGE ON THE BENTHIC INVERTEBRATE COMMUNITY OF THE INSHORE NEW YORK BIGHT,
Brooklyn Coll., NY. Dept. of Biology.
M. L. Botton.
Estuarine and Coastal Marine Science, Vol. 8, No. 2, p 169-180, February 1979. 2 fig, 6 tab, 24 ref.

Descriptors: *Sewage sludge, *New York, *Sludge disposal, *Marine animals, *Invertebrates, *Atlantic Ocean, Marine biology, Water pollution, Water quality, Surveys, Sampling, Sediments, Benthos, Benthic fauna, Biology, *New York Bight.

Benthic invertebrate community structure, including species diversity, biomass, and trophic structure, was examined at a sewage sludge disposal site and nearby 'control' site in the inner New York Bight off New York City. Although both sites are characterized by soft bottoms, have high organic carbon, and support similar deposit feeding assemblages, species diversity is lower at the sludge site, reflecting decreased species richness and evenness. Likewise, total biomass, as well as the proportional distribution of biomass among trophic groups, differed between sites. A previously suggested indicator species, Capitella capitata, is present in greater numbers at the control station than the sludge station. It is, therefore, unsuitable as an indicator species of pollution tolerance in the portion of the New York Bight examined in this study. A small polychaete belonging to the family Ampharetidae, Amage auricula, is by far the most abundant animal at the sludge disposal site, but its potential use as an indicator species is complicated by the fact that it exhibits a great tendency for aggregation. Ampelisid amphipods appear sensitive to the presence of sludge and may be useful as indicators of contamination. Most of the common animals at both stations were aggregated, and it was recommended

that future sampling in the area should be by the use of a larger number of small grabs such as the Shipek, rather than a smaller number of large grabs, as this will increase the probability that patchy fauna are encountered. (Sims-ISWS)
W79-06656

BIOTIC MONITORING,
Environmental Research Lab. Duluth, MN.
D. I. Mount.
In: Biological Monitoring of Water and Effluent Quality, ASTM STP 607, J. Cairns, Jr., K. L. Dickson and G. F. Westlake, Eds., American Society for Testing and Materials, 1977, p. 20-23.

Descriptors: *Bioassays, *Monitoring, *Pollution abatement, *Standards, *Industrial wastes, *Water Quality Control, Research and Development, Environmental effects, Water quality, Mortality, Toxicity, Water Quality Standards, Methodology, Sublethal effects, Prediction.

Past water pollution regulatory actions have dealt largely with eliminating existing unacceptable conditions from surface waters. Since the beginning of this decade, increased attention has been focused on preventing such conditions from developing. The shift has changed the informational need from one of assessing field conditions to one of predicting effects before they occur. A concomitant increased need for bioassays as predictive tools has occurred. Furthermore, analytical methods have not been developed to measure biologically active forms, and often they are not sensitive enough to measure concentrations at this 'no effect' level. In addition, the composition of wastes from today's industrial society are complex and variable and often contain many unidentified components. Therefore, aquatic bioassays are an essential tool for today's problems of aquatic environmental regulation. (Katz)
W79-06716

SOME MONITORING AND ANALYTICAL TECHNIQUES FOR THE STUDY OF LOCOMOTOR RESPONSES OF FISH TO ENVIRONMENTAL VARIABLES,
Texas A and M Univ., College Station. Dept. of Biology.
H. Kleerekoper.
In: Biological Monitoring of Water and Effluent Quality, ASTM STP 607, J. Cairns, Jr., K. L. Dickson and G. F. Westlake, Eds., American Society for Testing and Materials, 1977, p 110-120. 4 fig., 15 ref.

Descriptors: *Fish behavior, *Environmental effects, *Monitoring, *Water pollution effects, Analytical techniques, Equipment, Movement, Water temperature, Aquatic environment, Fish, Electronic equipment, Instrumentation, Methodology, *Sublethal effects, Responses, Locomotion, Avoidance.

The adaptive significance of locomotor, specifically orientation responses in fishes to environmental stimuli, is emphasized. General locomotor behavior is usually extremely variable over time whereas the responses mentioned are, most frequently, very subtle. Techniques are described to detect and quantify these responses by comparing locomotion before stimulation with that during exposure to the environmental variable(s) under study. Models for such comparisons are based on time series analysis of relevant locomotor variables, such as frequency and size of turns length and orientation of steps, velocity, and others. Two techniques for data acquisition of these variables, by means of monitoring locomotion thru electronics under controlled physical and chemical conditions, are described in some detail. Attention is called to the possible interaction of environmental conditions and the behavioral responses of fish, an aspect which, hitherto, has received too little consideration in studies on biological effects of environmental variables. (Katz).
W79-06717

SOME METHODS FOR HYPOTHESIS TESTING AND ANALYSIS WITH BIOLOGICAL MONITORING DATA,
Manitoba Univ., Winnipeg. Dept. of Zoology.
R. H. Green.
In: Biological Monitoring of Water and Effluent Quality, ASTM STP 607, J. Cairns Jr, K. L. Dickson and G. F. Westlake, Eds, American Society for Testing and Materials, 1977, p 200-211, 3 tab, 6 fig, 4 ref.

Descriptors: *Analytical techniques, *Distribution patterns, *Environmental effects, *Water pollution effects, *Mathematical studies, *Model studies, Spatial distribution, Temporal distribution, Monitoring, Benthos, Salts, Biological communities, Regression analysis, Methodology.

Procedures which are commonly used for determining the specific effect of an environmental change on a biological community are discussed and illustrated using a set of artificial data. Ninety-two stations on a kilometre grid are sampled for abundance of six benthic species and four environmental variables before and after an increased inflow of dissolved salts. A multiple regression model which assumes that species abundances are related to environmental variables in a linear additive manner yields inefficient and misleading results. Cluster analysis methods efficiently describe natural spatial patterns, but temporal changes are not detected. A linear additive model which relates changes in species abundances to changes in environmental variables removes the variation due to spatial pattern from the analysis and shows that biological changes related to increased salt concentrations have occurred. Methods for describing the changes and testing related hypotheses are presented. (Katz)
W79-06718

TIME AS A FACTOR IN BIOMONITORING ESTUARINE SYSTEMS WITH REFERENCE TO BENTHIC MACROPHYTES AND EPIBENTHIC FISHES AND INVERTEBRATES,
Florida State Univ., Tallahassee. Dept. of Biological Science.
R. J. Livingston.
In: Biological Monitoring of Water and Effluent Quality, ASTM STP 607, J. Cairns, Jr., K. L. Dickson and G. F. Westlake, Eds, American Society for Testing and Materials, 1977, p 212-234, 3 tab, 9 fig, 52 ref.

Descriptors: *Monitoring, *Seasonal, *Diurnal, *Temporal distribution, Analytical techniques, Estuaries, *Water pollution effects, Biorhythms, Benthic fauna, Invertebrates, Statistical methods, Sampling, Fish, Water quality, Oxygen, Salinity, Fishkill, Biomonitoring, Diversity, *Apalachicola Bay(Florida).

Biological monitoring programs of estuarine communities is complicated by the highly unstable physical environment and variations in temporal relationships due to diurnal, tidal, seasonal and annual periodicities. Implications of temporal variation of the natural environment are discussed relative to the biological sampling necessary to account for the variability; examples are taken from studies in three bay systems along the Gulf Coast of north Florida. Causative elements of the impact of pollutants should be viewed in terms of diurnal and seasonal variations. Against this background the timing of pollutant entry into the system could control the nature of the impact. Community structure can be masked or distorted by inadequate sampling either on a short-term or seasonal basis. This, together with seasonally directed changes in the actual impact of a given pollutant, should be taken into consideration in the design of a biomonitoring program. (Katz)
W79-06719

A LASER-BASED OPTICAL FILTERING SYSTEM TO ANALYZE SAMPLES OF DIATOM COMMUNITIES,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Biology.
K. L. Dickson, J. P. Slocomb, J. Cairns, Jr., and S. P. Almeida.
In: Biological Monitoring of Water and Effluent Quality, ASTM STP 607, J. Cairns, Jr., K. L. Dickson and G. F. Westlake, Eds., American Society for Testing and Materials, 1977, p 121-132. 8 fig, 7 ref.

Descriptors: *Monitoring, *Diatoms, *Water quality control, *Biological communities, *Instrumentation, Phytoplankton, Optical properties, Water pollution effects, Water quality, Research and development, Design, Analytical techniques, Microorganisms, Optical filtering system.

This paper describes a biomonitoring system currently being developed that employs coherent optical spatial filtering techniques to rapidly identify diatoms and process species-abundance information. Preliminary results indicate that the optical problems associated with such a system can be overcome, although investigations are continuing into the problem of interfacing a microscope directly to the optical system. This system could eventually be employed in a management program along with chemical and physical data to obtain full beneficial use of the ecosystem without damage. (Katz)
W79-06720

EVALUATION OF AN AUTOMATED BIOLOGICAL MONITORING SYSTEM AT AN INDUSTRIAL SITE,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Biology.
G. F. Westlake, and W. H. van der Schalie.
In: Biological Monitoring of Water and Effluent Quality, ASTM STP 607, J. Cairns, Jr., K. L. Dickson and G. F. Westlake, Eds., American Society for Testing and Materials, 1977, p. 30-37, 5 fig, 12 ref.

Descriptors: *Monitoring, *Bioindicators, *Technology, *Design, *Equipment, *Respiration, *Fish physiology, *Water quality control, *Industrial wastes, *Toxicity, Water quality, Pollutant identification, Pollution abatement, *Lepomis, *Biomonitor.

The feasibility of using biological monitoring of industrial point sources as a tool for river management has been demonstrated by a number of laboratory simulations. However, it is another task entirely to move these techniques to an industrial setting. The necessary modifications of a computerized biological monitoring system to install it in the Celanese Corporation Plant on the New River in Virginia are described. The system employs the respiration rates of bluegills (Lepomis macrochirus) as an indicator of abnormal variations in the effluent. (Katz)
W79-06721

MONITORING PROGRAM NEEDED FOR WISE TREATMENT CHOICES,
Beak Consultants Ltd., Vancouver (British Columbia).
K. Schiefer, and D. Lush.
Canadian Pulp and Paper Industry, Vol. 28, No. 5, p 34-35, 42-43, 46, May, 1975. 5 fig.

Descriptors: *Pulp and paper industry, *Waste water(Pollution), *Water pollution effects, *Environmental effects, *Surveys, Wastes, Industrial wastes, Water pollution sources, Toxicity, Biological properties, Water properties, Suspended solids, Dissolved solids, Dissolved oxygen, Biochemical oxygen demand, Hydrogen ion concentration, Toxins, Aquatic life, Water pollution.

The principal objective of an environmental monitoring program is to define the effects of discharged wastes on various environmental parameters before significant or irreversible damage is done. Three main components of a comprehensive monitoring program for the pulp and paper industry (i.e., chemical, toxicological, and biological analyses) are discussed. Chemical studies quantify the parameters (e.g., suspended solids, total dissolved solids, dissolved oxygen, BOD, pH, and concentrations of specific toxicants) of the receiv-

ing stream, while toxicological studies determine the effects of a specific effluent on life forms. Biological studies (examination of the aquatic community present in the receiving waters) provide an accurate assessment of the quality of the environment and evidence of any effect on the community which may be due to a mill effluent. A hypothetical monitoring program indicating the type of sampling array and typical parameters being measured is illustrated. (Sykes-IPC)
W79-06722

DETERMINATION OF ACETONE AND METHYL ETHYL KETONE IN WATER,
Geological Survey, NSTL Station, MS. Water Resources Div.
D. Y. Tai.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-291 151, Price codes: A03 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 78-123, October 1978. 36 p, 9 fig, 6 tab, 13 ref.

Descriptors: *Water analysis, *Organic compounds, *Analytical techniques, *Gas chromatography, Solvents, Water pollution, *Acetone, *Methyl ethyl ketone, Headspace analysis.

Analytical procedures for the determination of acetone and methyl ethyl ketone in water samples were developed. Concentrations in the milligram-per-liter range were determined by injecting an aqueous sample into the analysis system through an injection port, trapping the organics on Tenax-GC at room temperature, and thermally desorbing the organics into a gas chromatograph with a flame ionization detector for analysis. Concentrations in the microgram-per-liter range were determined by sweeping the headspace vapors over a water sample at 50C, trapping on Tenax-GC, and thermally desorbing the organics into the gas chromatograph. The precision for two operators of the milligram-per-liter concentration procedure, expressed as the coefficient of variation, was generally less than 2 percent for concentrations ranging from 16 to 160 milligrams per liter. The precision from two operators of the microgram-per-liter concentration procedure was between 2 and 4 percent for concentrations of 20 and 60 micrograms per liter. (Woodard-USGS)
W79-06812

AN APPROACH TO THE CLASSIFICATION OF UTAH MINE SPOILS AND TAILINGS BASED ON SURFACE HYDROLOGY AND EROSION,
Utah State Univ., Logan. Watershed Science Unit.
T. A. Burton, G. F. Gifford, and G. E. Hart.
Environmental Geology, Vol. 2, No. 5, p 269-278, 1978. 6 fig, 5 tab, 9 ref.

Descriptors: *Mine wastes, *Waste disposal, *Vegetation establishment, *Revegetation, *Mining, Coal mine wastes, Strip mine wastes, Mine water, Land subsistence, Spoil banks, Hydrology, Erosion, Overburden, Sediments, Land reclamation, Soil texture, Bulk density, Disposal, Compaction, Mulching, Statistical methods, Utah, Pollutants.

The present study classifies 35 mining deposits according to surface hydrologic and erosion characteristics within 24 Utah mining locations, 26 of which involves analysis of spoils or mined overburden wastes, 7 analysis of tailings, and 2 of ash deposits. Classification was achieved through cluster analysis to discover the inherent structure in the data and to evaluate similarities for the purpose of rating surface hydrologic limitations to revegetation. Results indicated that physical similarities among mine spoils may be strongly influenced by the geologic source of the spoils where overburden is produced from areas of simple geologic structure. Textures and bulk densities, on the other hand, are influenced by methods of handling during mining and disposal operations. Where these influences are the same in more than one site, surface hydrology and erosion parameters are often similar although a specific tailing deposit may be highly variable with respect to the physical and chemical characteristics produced by ore treatment and concentration. Suggestions for improved future rehabilitation with respect to the hydrologic characteristics of spoil deposits are: (1) conducting mining activities to permit identification and segregation of favorable overburden strata, (2) reconstituting soil for optimum plant growth, (3) shaping soils to be compatible with surrounding topography, (4) mulching with organic materials, and (5) avoiding compaction of the soil-spoil surface. (Tickes-Arizona)
W79-06844

SOURCE ASSESSMENT: TEXTILE PLANT WASTEWATER TOXICS STUDY -- PHASE I,
Monsanto Research Corp., Dayton, OH.
G. D. Rawlings.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-280 959, Price codes: A08 in paper copy, A01 in microfiche. Report No. EPA-600/2-78-004h, March 1978. 169 p, 22 fig, 48 tab, 13 ref, 6 append. 68-02-1874.

Descriptors: *Water pollution sources, *Pollutant identification, *Industrial wastes, *Water pollution treatment, *Evaluation, *Toxicity, *Effluents, *Textiles, Sewage treatment, Sampling, Bioassay, Chemical analysis, Nutrients, Data collections.

Sampling, chemical analysis and bioassay procedures described are used to establish a baseline data base concerning toxicity and level of priority pollutants present in raw waste water and secondary effluents at 23 U.S. textile plants. Samples were analyzed for 129 consent decree priority pollutants, effluent guidelines criteria pollutants and nutrients; Level 1 chemical analyses were performed. Secondary effluent samples were submitted for the following bioassays: mutagenicity, cytotoxicity, clonal assay, freshwater ecology series, marine ecology series, 14-day rat acute toxicity, and soil microcosm. Bioassay results showed that 10 of the 23 plants have secondary effluents sufficiently toxic to proceed to a second phase of study wherein samples will be collected from the 10 plants to determine the level of toxicity removal attained by selected tertiary treatments. The plants are ranked according to relative secondary effluent toxicity. Modifications and recommendations for improvements to the sampling, chemical analysis, and bioassay protocols are discussed. (Davison-IPA)
W79-06867

QUANTITATIVE TECHNIQUES FOR THE ASSESSMENT OF LAKE QUALITY,
Michigan State Univ., East Lansing. Dept. of Resource Development.
K. H. Reckhow.
Prepared for: Land Resource Programs Division, Inland Lake Management Unit and the Water Quality Division, Michigan Department of Natural Resources, Lansing, Michigan, September 1978. 138 p, 22 fig, 22 tab, 49 ref, 2 append.

Descriptors: *Lakes, *Management, *Water quality, *Assessment, *Eutrophication, *Phosphorus, *Quantitative methods, Model studies, Equations, Systems analysis, Sampling, Design, Data analysis, Lake classification.

The development of lake management policy calls for the determination of likely causal relationships among the lake and lake basin characteristics. This manual focuses on the role of phosphorus in lake eutrophication. Discussed is the importance of personal judgment of experienced managers in the design of a data gathering program and in the interpretation of the data and a model's prediction. On the whole, the manual outlines quantitative techniques that can be used to evaluate strategies for lake management. Chapter 2 presents a number of commonly employed statistical techniques for the design of sampling programs and for data analysis. Chapter 3 discusses the simple empirical models for phosphorus, and Chapter 4 outlines several schemes proposed for lake classification. Examples are presented to illustrate the use of the techniques described in those chapters. In conclusion, Chapter 5 briefly suggests additional research that may lead to refinements of the techniques presented herein. (Bell Graf-Cornell)
W79-06938

ACTINOMYCETES OF SEWAGE-TREATMENT PLANTS,
Rutgers - The State Univ., Piscataway, NJ. Waksman Inst. of Microbiology.
For primary bibliographic entry see Field 5D.
W79-06982

INDUSTRIAL PROCESS PROFILES FOR ENVIRONMENTAL USE: CHAPTER 2. OIL AND GAS PRODUCTION INDUSTRY,
Radian Corp., Austin, TX.
G. E. Wilkins.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-291 639, Price codes: A06 in paper copy, A01 in microfiche. Report EPA-600/2-77-023b, 1977. 130 p, 3 fig, 14 tab, 90 ref, 4 append.

Descriptors: *Oil industry, *Natural gas, *Effluent streams, *Waste water, *Pollutant identification, Water pollution sources, *Oily water, Brines, Sulfides, Air pollution, Industrial wastes.

The operations, processes, and effluent streams associated with the oil and gas production industry are characterized. Segments of the industry reviewed include: exploration and site preparation, drilling, crude processing, natural gas processing, and secondary and teritary recovery. Two process flow sheets and twenty process descriptions were developed to characterize operations. Input materials, operating parameters, utility requirements, and waste streams are reported for each process. The major waste streams resulting from oil and gas production contain hydrocarbons, oily brine, sulfides, sulfur compounds, and glycols. A large effluent stream is generated as a by-product of oil and gas production as an oily brine. Glycol-contaminated waste water is generated in natural gas processing. Offshore operations present a potential source of pollution when storms or shipping accidents cause uncontrollable well flows. Secondary recovery and drilling operations pose a potential contamination of aquifer zones by drilling fluids, brines, or hydrocarbons. Company and product information and related data are included. (Lisk-FRC)
W79-06984

INDUSTRIAL PROCESS PROFILES FOR ENVIRONMENTAL USE: CHAPTER 7. ORGANIC DYES AND PIGMENTS INDUSTRY,
Radian Corp., Austin, TX.
For primary bibliographic entry see Field 5B.
W79-06985

INDUSTRIAL PROCESS PROFILES FOR ENVIRONMENTAL USE: CHAPTER 10. PLASTICS AND RESINS INDUSTRY,
Radian Corp., Austin, TX.
For primary bibliographic entry see Field 5B.
W79-06986

INDUSTRIAL PROCESS PROFILES FOR ENVIRONMENTAL USE: CHAPTER 26. TITANIUM INDUSTRY,
Radian Corp., Austin, TX.
For primary bibliographic entry see Field 5B.
W79-06987

5B. Sources Of Pollution

ENVIRONMENTAL ASSESSMENT OF THE ALASKAN CONTINENTAL SHELF. QUARTERLY REPORTS OF PRINCIPAL INVESTIGATORS JULY - SEPTEMBER 1978, VOLUME I.
For primary bibliographic entry see Field 5C.
W79-06510

ENVIRONMENTAL ASSESSMENT OF THE ALASKAN CONTINENTAL SHELF. QUARTERLY REPORTS OF PRINCIPAL INVESTIGATORS JULY - SEPTEMBER 1978. VOLUME II.
December 1978. 678 p, NOAA, Environmental Research Laboratories, Boulder, CO. Outer Continental Shelf Environmental Assessment Program.

Descriptors: *Baseline studies, *Alaska, *Hazards, *Water pollution effects, *Resources development, *Environmental effects, Data processing, Oil pollution, Gases, Geology, *Outer Continental Shelf, Petroleum development, Quarterly reports.

Quarterly reports delineate objectives and progress in baseline studies designed to assess the environmental impact of resources development on Alaska's Outer Continental Shelf. Emphasis is on hazards, transport, contaminant baselines and data management. (See also W79-06510) (Sinha-OEIS)
W79-06511

ENVIRONMENTAL ASSESSMENT OF THE ALASKAN CONTINENTAL SHELF. QUARTERLY REPORTS OF PRINCIPAL INVESTIGATORS OCTOBER - DECEMBER 1978. VOLUME II.
March 1979. 54p, NOAA, Environmental Research Laboratories, Boulder, CO. Outer Continental Shelf Environmental Assessment Program.

Descriptors: *Baseline studies, *Alaska, *Resources development, *Environmental effects, *Water pollution effects, Hazards, *Data, Transportation, *Outer Continental Shelf, Petroleum development.

Volume II contains numerous brief quarterly reports of work in progress or planned which examines the effects of resources development on the Outer Continental Shelf of Alaska. Various hazards and problems in the transport of petroleum resources, and efforts on data management are encompassed. (See also W79-06512) (Sinha-OEIS)
W79-06513

PASSAGE OF ANTICYCLONIC GULF STREAM EDDIES THROUGH DEEPWATER DUMPSITE 106 DURING 1974 AND 1975,
National Marine Fisheries Service, Narragansett, RI. Atlantic Environmental Group.
J. J. Bisagni.
Available from Supt. of Documents, GPO, Washington, DC 20402, Price, $1.15. NOAA Dumpsite Evaluation Report 76-1, April 1976. 43 p, 28 fig, 3 tab, 24 ref.

Descriptors: *Eddies, *Spoil banks, *Meanders, *Anticyclones, *Environmental effects, Water pollution sources, Waste disposal, Path of pollutants, *Outer Continental Shelf, *Ocean dumping, Gulf Stream, New York Bight, Oceanographic data.

The formational theory and characteristics of anticyclonic Gulf Stream eddies in the western North Atlantic Ocean are summarized. Their occurrence, trajectories, and structure, are observed using XBT data and infrared satellite imagery to relate their passage through Deepwater Dumpsite 106 off the New York Bight and over the continental slope and rise. The frequency with which these eddies pass through the dumpsite, their residence times within the dumpsite, and the total time they occupy the dumpsite each year are computed to determine their potential effects on ocean dumping. (Sinha-OEIS)
W79-06514

SUMMARY OF POTENTIAL HAZARDS AND ENGINEERING CONSTRAINTS, PROPOSED OCS LEASE SALE NO. 48, OFFSHORE SOUTHERN CALIFORNIA,
M. R. Ploessel, S. C. Crissman, J. H. Rudat, R. Son, and C. F. Lee.
In: Proceedings, Eleventh Annual Offshore Technology Conference, Houston, TX, April 30-May 3, 1979. Volume 1, p 355-363, 13 fig, 6 ref, Oct No 3398. Offshore Technology Conference, Dallas TX. 1979.

Descriptors: *Hazards, *Resources development, *California, Leases, Oil pollution, Water pollution sources, Geology, Exploration, Sites, Baseline studies, *Outer Continental Shelf, Petroleum development, Souther California, Geotechnical conditions.

Potential hazards and engineering constraints identified in proposed Outer Continental Shelf (OCS) Lease Sale Area No. 48, offshore southern California, include water deeper than 1000 ft, seafloor slopes of 4 to 70%, submarine canyons and channels, assorted mass movement phenomena, faults, possible accumulations of gas in the shallow sediments, and locally hard and irregular seafloor. These features and conditions were identified in a reconnaissance, multi-sensor high resolution seismic survey. Prior to developmental activities, detail site specific studies will be necessary to determine the potential influence of geologic features and conditions. Safe and environmentally acceptable exploration and development of possible petroleum resources appears feasible, provided the geologic and geotechnical conditions within the area are fully recognized and appropriate mitigating measures are taken to prevent potential problems. (Sinha-OEIS)
W79-06515

A SUMMARY OF INTERACTING, SURFICIAL GEOLOGIC PROCESSES AND POTENTIAL GEOLOGIC HAZARDS IN THE NORTON BASIN, NORTHERN BERING SEA,
D. R. Thor, and H. Nelson.
In: Proceedings of Eleventh Annual Offshore Technology Conference, held Houston, TX, April 30-May 3, 1979. Volume 1, p 377-385, 7 fig, 25 ref, OTC No 3400. Offshore Technology Conference, Dallas, TX 1979.

Descriptors: *Hazards, *Geology, *Alaska, *Water pollution sources, Resources development, Leases, Oil pollution, Environmental effects, Baseline studies, Sediments, Erosion, *Outer Continental Shelf, Bering Sea, Norton Sound, Petroleum development.

A dynamic environment of moderate tectonism, sediment instability, and active erosional and depositional processes on the shallow sea floor of northern Bering Sea creates several potential geologic hazards. Active faulting, thermogenic gas seeps, sea-floor gas cratering, sediment liquefaction, ice gouging, scouring-depression formation, storm-sand deposition, and large-scale bedform movement all occur in the study area. Geologic processes may interact to cause such potential hazards as nearsurface faulting south of Nome, Alaska that provides pathways for seeps of thermogenic gas leaking from a large subsurface gas accumulation. Numerous faults also cut the sea floor in the area west of Port Clearance; fault activity is difficult to determine, however, because current scour may be preserving or exhuming old fault scarps. Interaction between the processes of liquefaction and the formation of gas craters, scour depressions, storm-sand deposits, and slumps results in potential sediment instability problems. The widespread occurrence of gas-charged sediment with small surficial craters in central Norton Sound indicates that the sea-floor sediment is periodically disrupted by sudden venting of biogenic gas from the underlying peaty mud. During major storms, liquefaction not only may help trigger crater formation, but also may enhance erosional and depositional processes that create large-scale scour areas and transport sand in the Yukon prodelta area. Interaction of erosional and depositional processes may result in hazards in the shallower parts of northern Bering Sea. (Sinha-OEIS)
W79-06516

NATURAL GAS SEEPAGE ON THE SOUTH TEXAS SHELF,
Texas A and M Univ., College Station.
J. M. Brooks, B. B. Bernard, W. M. Sackett, and J. R. Schwarz.
In: Proceedings of Eleventh Annual Offshore Technology Conference, held Houston, TX, April 30-May 3, 1979. Volume 1, p 471-478, 7 fig, 1 tab, 20 ref, OTC No 3411. Offshore Technology Conference, Dallas, TX 1979.

Descriptors: *Seepage, *Water pollution sources, *Bacteria, *Texas, Baseline studies, Sediments, Water pollution effects, Environmental effects, Resources development, *Outer Continental Shelf, *Hydrocarbons, Petroleum development.

An area of extensive gas seepage has been found on the South Texas shelf. The seep area extends for a distance of approximately 25 miles on a transect out from the coast at latitude 26 degrees 10 minutes N. Water depths range between 65 and 130 meters. During nine samplings over a three year period, elevated near-bottom concentrations of methane (up to 500 nl/L), ethane (0.6 nl/LO, and propane (0.5 nl/L) compared to nearby surface and other near-bottom waters were observed. Anomalous gaseous hydrocarbon levels were also observed in the interstitial waters at three stations sampled in the region. Ethane and propane concentrations were typically one order of magnitude higher in these sediments compared to typical South Texas shelf sediments. The C sub 1/(C sub 2 + C sub 3) ratios in the sediments were as low as 14 indicating that the seepage may be of a petrogenic origin and not from shallow biogenic (microbial) sources. Significantly higher percentages of hydrocarbonoclastic bacteria were observed in the seep area. These may be a direct result of hydrocarbon seepage. No anomalous interstitial gas concentrations were observed in the 'Serendipity Gas Seep Area' of South Texas. (Sinha-OEIS)
W79-06517

BIOGENIC AND THERMOGENIC GAS IN GAS-CHARGED SEDIMENT OF NORTON SOUND, ALASKA,
K. A. Kvenvolden, C. H. Nelson, D. R. Thor, M. C. Larsen, and G. D. Redden.
In: Proceedings of Eleventh Annual Offshore Technology Conference, held Houston, TX, April 30-May 3, 1979. Volume 1, p 479-486, 3 fig, 2 tab, 21 ref, OTC No 3412. Offshore Technology Conference, Dallas, TX 1979.

Descriptors: *Hazards, *Geology, *Water pollution sources, *Alaska, *Engineering geology, Sediments, Seepage, Natural gas, Resources development, Baseline studies, Environmental effects, *Outer Continental Shelf, Petroleum development, Biogenic gas, Thermogenic gas.

Chemical and isotopic compositions of sediment gas from Norton Sound have been determined for near-surface, gas-charged sediments at two sites identified in acoustic profiles and bottom observations. At one site air-driven vibracorer penetrated sediment saturated with methane. The isotopic value suggests that the methane originated from active biological processes operating on peat in the top 4 m of sediment. At the other site, characterized by a large subsurface acoustic anomaly, smaller near-surface acoustic anomalies and active seepage of gas, the vibracorer obtained sediment saturated with gas composed of 98% CO2. Associated with the CO2 are minor concentrations of petroleum-like light hydrocarbons. The carbon isotopic compositions of CO2 and methane along with the chemical distribution of gaseous hydrocarbons indicate that at this site these gases are derived from thermal processes operating at depth in Norton Basin. Apparently CO2 from the decarbonation of marine limestone acts as a carrier for hydrocarbon gases that have been generated from organic matter buried in the basin. The gases reach the surface by faults and escape at the seafloor as a submarine seep. The presence of near-surface gas-charged sediment in Norton Sound reduces the stability of the seafloor. Areas where sediments are charged with gas may pose potential hazards for engineering developments. (Sinha-OEIS)
W79-06518

AT-SEA DISCHARGE OF OCEAN MINING PROCESS REJECTS - AN ALTERNATIVE TO LAND DISPOSAL,

C. L. Morgan, and F. T. Lovorn.
In: Proceedings of Eleventh Annual Offshore Technology Conference, held Houston, TX, April 30-May 3, 1979. Volume 2, p 807-813, 1979. 2 fig, 19 ref, OTC No. 3451. Offshore Technology Conference, Dallas, TX.

Descriptors: *Waste disposal, *Mining, *Water pollution sources, *Baseline studies, Resources development, Water pollution effects, Environmental effects, *Outer Continental Shelf, North Pacific Ocean, At-sea discharge.

The Ocean Minerals Company has carefully evaluated potential impacts of ocean discharge even when most of the evidence suggests that significant impacts do not occur. This 'worst case' approach is similar to that which has been adopted by most principal investigators in the DOMES program. During the last several years an 'in house' project has focused upon a number of topics which compliment those covered by the government programs or which are peculiar to the OMCO system. These include: (1) baseline measurement of metal values in the oceans; (2) determination of the settling rates and solid/liquid composition of various mixtures of seawater and reject materials; (3) comparison of the effects of land-based discharge with the effects of at-sea discharge; and (4) design of a long term environmental monitoring system. To date, these studies indicate that at-sea discharge may cause an insignificant amount of environmental damage and is in many ways preferable to land discharge. (Sinha-OEIS)
W79-06519

A COLLISION AVOIDANCE SYSTEM FOR OFFSHORE OPERATIONS,
R. F. Riggs.
In: Proceedings of Eleventh Annual Offshore Technology Conference, held Houston, TX, April 30-May 3, 1979. Volume 2, p 1291-1299, 1979. 9 fig, 2 tab, 15 ref, OTC No. 3504. Offshore Technology Conference, Dallas, TX.

Descriptors: *Hazards, *Navigation, *Oil pollution, Oil spills, Water pollution sources, Resources development, *Outer Continental Shelf, Collision avoidance, Oil transport, Predicted-area-of-danger(PAD).

The surge of offshore resource development has resulted in a high density of both fixed and mobile hazards to navigation in some areas. The situation is aggravated when coastal shipping encounters these hazardous areas. Collisions between tankers, rigs, drilling platforms, etc., may result in serious danger to personnel, equipment losses and oil spills. In certain weather conditions, lights and acoustic signaling devices may be ineffective as collision avoidance aids and reversion to radar as the primary sensor may be inevitable. Greatly reduced probability of collision can be achieved through the use of an automated collision avoidance aid that permits rapid assessment of the situation and the determination of a safe, efficient maneuver. Types of operational collision avoidance systems are reviewed and compared. The mix of moving and fixed hazards is one problem that the system must handle. Tidal currents and winds can complicate the maneuvering solution. It is shown that the use of the predicted-area-of-danger (PAD) as a collision avoidance concept overcomes the problems peculiar to maneuvering in offshore gas and oil fields. Experience with the highly successful use of the PAD concept in the dense traffic of the English Channel is reviewed. (Sinha-OEIS)
W79-06520

AN INTRODUCTION TO THE OILSPILL RISK ANALYSIS MODEL,
K. J. Lanfear, R. A. Smith, and J. R. Slack.
In: Proceedings of Eleventh Annual Offshore Technology Conference, held Houston, TX, April 30-May 3, 1979. Volume 4, p 2173-2181, 11 fig, 4 tab, 7 ref, OTC No 3607. Offshore Technology Conference, Dallas, TX 1979.

Descriptors: *Oil spill, *Hazards, *Models, *Risks, Water pollution effects, Path of pollutants, Environmental effects, Resources development, *Outer Continental Shelf, Petroleum development, Risk analysis.

The U.S. Geological Survey has developed an oilspill risk analysis model to aid in estimating the environmental hazards of developing oil resources in Outer Continental Shelf (OCS) lease areas. This large, detailed, computerized model analyzes the probability of spill occurrence, likely paths of the spills, and locations of recreational and biological resources which may be vulnerable. The analysis implicitly includes estimates of weathering rates, slick dispersion, and possible mitigating effects of cleanup. The probability of spill occurrence is estimated from information pertaining to the volume of oil expected to be produced and the anticipated method and distance of transport. The model provides the Department of the Interior with a method for realistically assessing oilspill risks associated with OCS development. So far, it has been used for analyzing oilspill risks for eight OCS lease sales, and the results have been incorporated into several environmental impact statements. A 'real-time' version was also used to forecast the movement of the Argo Merchant oilspill. Additional model runs are planned for future OCS lease sales in frontier areas. Other possible applications include analysis of OCS development alternatives and site selection for oilspill cleanup equipment. (Sinha-OEIS)
W79-06523

SHIPBOARD OILY WATER POLLUTION - A PRACTICAL GUIDE FOR THE OWNER AND DESIGNER,
A. D. Isaacson.
In: Proceedings of Eleventh Annual Offshore Technology Conference, held Houston, TX, April 30-May 3, 1979. Volume 4, p 2183-2192, 5 fig, 12 ref, OCT No 3608. Offshore Technology Conference, Dallas, TX 1979.

Descriptors: *Oil pollution, *Pollution abatement, *Water pollution control, Resources development, Oily water, Ships, Regulation, Transportation, *Outer Continental Shelf, Petroleum development, Oily water separators.

This paper is presented as an aid in understanding the U.S. and International (IMCO) regulations with regard to shipboard oil pollution and as a guide for selecting and installing an oily water separating device as it pertains to a particular situation. The information presented is based upon recent projects in which various type vessels have been upgraded to comply with oil pollution regulations. The latest information regarding IMCO and US Coast Guard regulations as applicable to new and existing vessels are presented as well as means for complying. Covered are the various areas of possible shipboard oily water contamination such as machinery bilges, tank cleaning and oil transfer operations. Commercially available oily water separators are discussed and presented to assist the reader to judge the applicability for his particular case. (Sinha-OEIS)
W79-06524

WESTERN GULF OF ALASKA SEISMIC RISK,
Alaska Univ., Fairbanks. Geophysical Inst.
H. Pulpan, and F. Kienle.
In: Proceedings of Eleventh Annual Offshore Technology Conference, held Houston, TX, April 30-May 3, 1979. Volume 4, p 2209-2218, 12 fig, 19 ref, OTC No 3612. Offshore Technology Conference, Dallas, TX 1979.

Descriptors: *Seismic studies, *Hazards, *Alaska, *Risks, Model studies, Baseline studies, Water pollution sources, Resources development, *Outer Continental Shelf, Petroleum development.

Seismicity studies, based on both historic data and data accumulated from the operation of a high resolution seismic network, provide some important input into quantitative seismic risk studies for areas of offshore petroleum development in Lower Cook Inlet, Shelikof Strait and off Kodiak Island. The greatest seismic risk is associated with the shallow seismic thrust zone of the subducting Pacific plate. There is a high probability that a great earthquake will occur in the Shumagin gap within the lifetime of any potential petroleum development in that area. The relative sharpness of the transarc boundaries of the aftershock zones of great earthquakes in the Aleutians suggests that a shallow thrust zone is segmented into separate tectonic blocks within release accumulated strain independently. There is geologic and seismic evidence that one such boundary traverses the arc near the southern edge of Kodiak and separates the 1964 aftershock zone from the Shumagin gap. Additional segmentation may exist within the 1964 aftershock zone. Seismic risk appears lower in the other offshore areas that do not overlie the shallow subduction thrust zone, but is still primarily associated with the subduction process. The shallow, crustal seismic activity (less than 50 km hypocentral depth) outside the subduction thrust zone does not correlate with the major known fault systems of the area, and is of a more diffuse nature. (Sinha-OEIS)
W79-06527

A SEA-FLOOR SEISMIC MONITORING NETWORK AROUND AN OFFSHORE OILFIELD PLATFORM AND RECORDING OF THE AUGUST 13, 1978 SANTA BARBARA EARTHQUAKE,
University of Southern California, Los Angeles.
T. L. Henyey, T-I. Teng, J. K. McRaney, and D. V. Manov.
In: Proceedings of Eleventh Annual Offshore Technology Conference, held Houston, TX, April 30-May 3, 1979. Volume 4, p 2219-2223, 6 fig, 16 ref, OTC No 3613. Offshore Technology Conference, Dallas, TX 1979.

Descriptors: *Hazards, *Seismic studies, *Risks, *Monitoring, *California, Offshore platforms, Water pollution sources, Resources development, Oil fields, Earthquakes, *Outer Continental Shelf, Petroleum development, Santa Barbara(CA) earthquake.

An eight element seismic monitoring array has been established around the Dos Cuadras offshore oil field in the Santa Barbara Channel, a highly faulted region with a history of important seismicity. The array consists of five sea floor seismometers and three onshore coastal zone stations. The proper mechanical coupling of ocean-bottom seismometers to the sea floor has been a problem. The existence of a layer of soft sediments on top of the sea floor often results in severe attenuation of the transmitted seismic waves. A method has been devised of installation whereby the sea floor sensors are inserted into pipes vibracord 2-5 meters into the sea floor where water depths range from 20 to 100 meters. The sensor outputs are transmitted by sea floor coaxial cables to a central platform and then telemetered (in combination with the onshore stations) via telephone line to a recording facility in Los Angeles. Records from the August 13, 1978 Santa Barbara earthquake and its aftershocks demonstrate that the method of sensor emplacement used gives superior coupling to the sea floor resulting in a record with low distortion and good signal to noise characteristics. The minimum detection threshold for events within the Dos Cuadras field should be on the order of M = 1.5 with epicentral locations determined to better than 1 km. The added complexities of offshore oil fields enhance the desirability of a comprehensive seismic monitoring effort. (Sinha-OEIS)
W79-06528

ENVIRONMENTAL HAZARDS: CONSIDERATIONS FOR OUTER CONTINENTAL SHELF DEVELOPMENT,
P. G. Teleki, L. E. Garrison, and M. A. Hampton.
In: Proceedings of Eleventh Annual Offshore Technology Conference, held Houston, TX, April 30-May 3, 1979. Volume 4, p 2579-2589, 66 ref, Oct No 3654. Offshore Technology Conference, Dallas, TX 1979.

Descriptors: *Hazards, *Resources development, *Risks, *Baseline studies, Environmental effects,

Water pollution sources, United States, Oil pollution, Offshore platforms, *Outer Continental Shelf, *Potential hazards, Petroleum development.

Expansion of offshore petroleum operations into unknown frontier areas, deeper waters, and more hostile environments has increased industry's and the Government's awareness about environmental hazards on the Outer Continental Shelf (OCS). Data on environmental exposure are absent in the public domain although these data (1) are needed to test engineering concepts for the design of offshore structures, (2) are factors in leasing on the OCS, and (3) govern economic decisions on petroleum exploration and production. The summary of environmental hazards on the U.S. Continental Shelf presented shows much variability in the hazard potential among OCS areas and complex interactions among various types of hazards within a single area. The U.S. Geologic Survey is actively studying the stability and properties of marine sediments, extreme wave conditions, earthquake-induced ground motion, and arctic sea ice and permafrost to improve its understanding of the processes governing the existence and behavior of these hazards. (Sinha-OEIS)
W79-06529

AUTOMATED SAMPLING ANALYSIS OF RURAL NONPOINT SOURCE WATER QUALITY,
North Carolina State Univ. at Raleigh. Dept. of Biological and Agricultural Engineering.
L. F. Bliven, F. J. Humenik, F. A. Koehler, and M. R. Overcash.
Paper No. 78-2509, Presented at the 1978 Winter Meeting of the American Society of Agricultural Engineers, December 18-20, 1978, Chicago, Illinois, 10 p. 5 fig, 4 tab, 18 ref. ASAE, St. Joseph, Michigan.

Descriptors: Water quality, Water pollution, Water sampling, Water pollution sources, *Automation, Water yield, Ion transport, Base flow, Flow duration, *Nonpoint pollution.

Automated sampling was employed to assess constituent (COD, TOC, TP, TKN, NO3-N, and Cl) yields and concentrations from two Piedmont sites in Virginia and two poorly-drained Coastal Plain sites in North Carolina within the Chowan River watershed. These data were analyzed to provide a mechanistic interpretation of subbasin processes. Characteristic Piedmont and Coastal Plain seasonal water yield cycles which have winter maximums and summer minimums were related to regional potential water yields (rainfall minus evapotranspiration). Large water yield variations for subbasins within each region, however, were attributed to physical differences between subbasins. Greater water yield from the agricultural Piedmont site than from the forested Piedmont site reflected increased cleared land plus greater channelization both on the basis of channel density and channel gradient at the agricultural site. Elevated baseflow, probably due to stream channelization, was the dominant factor contributing to water yield due to stream channelization, was the dominant factor contributing to water yield differences between two Coastal Plain subbasins. Surface flow COD, TOC, TP, TKN and NO3-N concentrations were usually greater than baseflow concentrations, but at the unchannelized Coastal Plain site the opposite case prevailed and at all sites surface flow Cl concentrations were less than baseflow concentrations. The seasonal concentration cycle displayed a summer maximum and winter minimum and thus it was out of phase with the water yield cycle. (Skogerboe-Colorado State)
W79-06548

KEPONE/MIREX/ HEXACHLOROCYCLOPENTADIENE: AN ENVIRONMENTAL ASSESSMENT.
National Research Council, Washington, DC.
For primary bibliographic entry see Field 5C.
W79-06566

CONTAMINANTS ASSOCIATED WITH DIRECT AND INDIRECT REUSE OF MUNICIPAL WASTEWATER.
SCS Engineers, Long Beach, CA.
For primary bibliographic entry see Field 5C.
W79-06567

BOOMS USED FOR OIL SLICK CONTROL,
National Water Research Inst., Burlington (Ontario).
For primary bibliographic entry see Field 5G.
W79-06589

STORM RUNOFF MICROBIOLOGY ADDS TO CONCERNS,
Ontario Ministry of the Environment, Rexdale.
A. A. Qureshi, and B. J. Dutka.
Water and Sewage Works, Vol 126, No 3, p 86-88, March 1979. 1 fig, 2 tab, 7 ref.

Descriptors: *Water pollution sources, *Canada, *Urban runoff, *Storm drains, *On-site investigations, Storm runoff, Surface runoff, Water sampling, Water pollution, Pollutants, Coliforms, Fungi, Pathogenic bacteria, Analysis, Methodology, Testing procedures.

A storm sewer outfall on Malvern Road in Burlington, Ontario, (population 104,000) was selected as a study site. This outfall empties directly into small creek and drains a 23.3 ha section of central Burlington. The entire area is zoned as single-family, residential, and there are no vacant lots within the area. The majority of the houses have eaves-troughs connected directly to storm sewers that are 100% separated. Routine microbiological samples for coliforms, fecal coliforms, fecal streptococci, Pseudomonas aeruginosa, fungi, heterotrophs, salmonella/100 ml, and Leptospira/100 ml were hand-collected at the weir outfall. The first samples were collected after the rain started, as soon as there was a noticeable change in the flow rate. Traditional indicator densities such as coliforms, fecal coliforms, and fecal streptococci approached dilute sewage concentrations during each event, thus reemphasizing the health hazards due to pathogenic bacteria and viruses that are contained within these storm-runoff waters. Indications were that it is not possible to predict peak time for microbial populations to occur in runoff waters or the appearance of human pathogens. (Humphreys-ISWS)
W79-06590

ON THE CONCENTRATION OF SULFATE IN PRECIPITATION,
Battelle Pacific Northwest Labs., Richland, WA.
B. C. Scott, and N. S. Laulainen.
Journal of Applied Meteorology, Vol 18, No 2, p 138-147, February 1979. 6 fig, 4 tab, 26 ref. ERDA EY-76-C-06-1830.

Descriptors: *Sulfates, *Precipitation(Atmospheric), *Nucleation, Air pollution, Clouds, Cloud physics, On-site investigations, Radar, Sampling, Chemical analysis, Drops(Fluid), Snow, Aerosols, Chemicals, Sulfur compounds, Meteorology.

Two case studies were used to examine the relationship of the sulfate concentration in surface precipitation to the microphysical characteristics of the precipitating cloud systems. The data from one case study supported the contention that existing sulfate aerosol was incorporated into cloud water by the nucleation process and accounted for nearly all of the observed cloud and precipitation water sulfate concentration. These activated sulfate particles comprised nearly 60% of the clear-air sulfate mass concentration. Once nucleated, the sulfate particles accumulated water through the condensation process and were subsequently deposited at the surface after accretion on large snowflakes. The presumption of aqueous phase sulfate oxidation of SO2 was not necessary to account for the observed sulfate concentrations. The data from the second case study were more limited and difficult to interpret. Nucleation and below cloud washout appeared to be the main contributors to the surface concentration in precipitation water. (Sims-ISWS)
W79-06592

CHEMICAL LOADINGS TO SOUTHWESTERN LAKE SUPERIOR FROM RED CLAY EROSION AND RESUSPENSION,
Wisconsin Univ.-Superior. Dept. of Chemistry.
For primary bibliographic entry see Field 2H.
W79-06599

HYDROLOGIC IMPACTS OF SILVICULTURAL ACTIVITIES,
Rocky Mountain Forest and Range Experiment Station, Fort Collins, CO.
For primary bibliographic entry see Field 4C.
W79-06606

TRANSPORT OF REACTING ADMIXTURES IN A TURBULENT FLOW,
Akademiya Nauk SSSR, Moscow. Inst. Vodnykh Problem.
B. A. Fidman.
Water Resources, Vol 4, No 6, p 918-925, November-December 1977. 10 ref. Translated from Vodnye Resursy, No 6, p 148-155, November-December 1977.

Descriptors: *Turbulent flow, *Mixing, *Suspended solids, *Pollutants, Water pollution, Diffusion, Dispersion, Model studies, Mathematical models, Equations, Sediment transport, Streams, Streamflow, Hydraulics, Hydrology.

The transport by turbulent flows of admixtures which can react with solutions or fine particles contained in the water is of interest, particularly when analyzing processes of pollution and self-purification of streams and water bodies. This article touched on (as a brief review with explanations and comments) certain characteristics of the joint action of turbulent diffusion and kinetics of the reactions. An estimation of the parameters of transport and mixing of reacting admixtures in a turbulent flow as a consequence of a number of simplifying assumptions can give only rather rough, approximate results. Refinement and broadening of the results obtained as applied to more complex conditions requires the further development of investigations of turbulent transport and, in turn, such characteristics of it as longitudinal dispersion and the transverse (horizontal) turbulent diffusion determining it in natural and regulated streams. Further actual measurements on large streams, permitting an empirical determination of the values of longitudinal dispersion, are also needed. (Sims-ISWS)
W79-06613

FACTORS GOVERNING THE BIOLOGICAL PRODUCTIVITY, REGIME, AND CONTENT OF BIOGENIC AND ORGANIC SUBSTANCES IN THE SEQUENCE OF DNEPR RESERVOIRS,
Akademiya Nauk URSR, Kiev. Inst. Hydrobiologii.
A. I. Denisova.
Water Resources, Vol. 4, No. 6, p 885-895, November-December 1977. 4 tab, 13 ref. Translated from Vodnye Resursy, No. 6, p 106-119, November-December 1977.

Descriptors: *Organic matter, *Biological properties, *Water quality, *Reservoirs, Nutrients, Nitrogen compounds, Phosphorus, Vegetation, Trees, Phytoplankton, Runoff, Rivers, Water pollution, Water pollution sources, *Dnepr River(USSR), Biogenic matter.

Organic and biogenic substances, being the basis of biological productivity of water bodies, in the majority of cases determine also the quality of water used for various economic purposes. Systematic investigations carried out on reservoirs of the Dnepr River over the course of two decades (1955-1975) revealed the main factors and processes governing the content, dynamics, and transformation of bioelements in reservoirs and their bio-

logical productivity. The content of biogenic and organic substances in water of reservoirs depends on two diametrically opposite processes: on one hand, on their entry with different sources and, on the other, on their removal from the aquatic environment in the form of the end products of mineralization of substances of plant and animal origin, sedimentation, consumption by aquatic organisms, binding by heavy metals into stable complexes, etc. The sources enriching the water of Dneper reservoirs in biogenic elements and organic substances of both natural and antropogenic origin include: the runoff of the main river feeding the sequence of reservoirs, surface runoff and interflow from the drainage basin, flooded bed (in the first years), industrial and domestic wastewaters, runoff from farmlands, precipitation, erosion of the shores, bottom deposits, in situ processes, etc. Their quantitative evaluation, made on the basis of experimental and actual investigations or by calculations, was presented. (Sims-ISWS)
W79-06614

ACCURACY EVALUATION IN THE CALCULATION OF MASS-DISCHARGES,
National Inst. of Scientific Research (Quebec).
H. Weber, D. Cluis, and B. Bobee.
Journal of Hydrology, Vol. 40, No. 1/2, p 175-184, January 1979. 3 fig, 9 ref.

Descriptors: *Water quality, *Dissolved solids, *Discharge(Water), *Hysteresis, Sampling, Variability, Statistical methods, Simulation analysis, Flow, Estimating, Analysis, Equations, *Mass discharge, *Concentration, *Nonpoint sources, *Saint-Francis River.

Water quality sampling programs are designed mostly upon known or assumed variabilities of the concentrations. As one goes further into the interpretation of this information, mass-discharge calculation is often required afterwards for the evaluation of transport phenomena. The accuracy of mass-discharges is generally related to the errors in the flow and concentration measurements, but the inaccuracy resulting from the computational procedure itself is often overlooked, leading to gross misinterpretations. In the common case of a basin with composite land-uses, no clear-cut relationship between concentrations and discharges can be expected. With discharges available on a daily basis and water quality samplings occurring at periodic intervals, several approximation formulas for mass-discharge computation are available. A formulation was retained taking advantage of the whole information content of the measurements, and a simulation technique was applied to estimate its accuracy. The results were then presented in terms of accuracy estimations in relation to the frequencies of sampling and to the intrinsic variabilities and relative cyclicities of concentrations and discharges. (Singh-ISWS)
W79-06619

METHOD FOR LAKE RESTORATION,
Battelle Memorial Inst., Richland, WA. (Assignee).
For primary bibliographic entry see Field 5G.
W79-06640

FLUCTUATIONS OF CHLOROPHYLL AND RELATED PHYSICAL PARAMETERS IN BRITISH COLUMBIA COASTAL WATERS,
British Columbia Univ., Vancouver. Inst. of Oceanography.
For primary bibliographic entry see Field 2L.
W79-06644

SPECTRAL AND BIOCHEMICAL CHARACTERISTICS OF THE PARTICULATE MATTER IN BEDFORD BASIN,
Biochimie Marine, Villefranche-sur-Mer (France). Station Zoologique.
For primary bibliographic entry see Field 2L.
W79-06645

SUMMER PLANKTON DISTRIBUTIONS ASSOCIATED WITH THE PHYSICAL AND NUTRIENT PROPERTIES OF THE NORTHWESTERN GULF OF ST. LAWRENCE,
Quebec Univ., Rimouski. Dept. of Oceanography.
For primary bibliographic entry see Field 2L.
W79-06646

DISTRIBUTION OF NUTRIENTS IN THE GULF OF ST. LAWRENCE,
Bedford Inst. of Oceanography, Dartmouth (Nova Scotia). Atlantic Oceanographic Lab.
For primary bibliographic entry see Field 2L.
W79-06650

LINE PLUME AND OCEAN OUTFALL DISPERSION,
Georgia Inst. of Tech., Atlanta. Dept. of Civil Engineering.
P. J. W. Roberts.
Journal of the Hydraulics Division, American Society of Civil Engineers, Vol. 105, No. HY4, Proceedings Paper 14488, p 313-331, April 1979. 12 fig, 12 ref, 2 append.

Descriptors: *Outfall sewers, *Dispersion, *Diffusion, *Waste dilution, Mixing, Flow, Currents(Water), Buoyancy, Model studies, Mathematical models, Laboratory tests, Froude number, Equations, Oceans, Waste disposal, Plumes, Dilution, Diffusers.

The three-dimensional flowfield created by a line plume of finite length in a steady unstratified current was investigated experimentally and theoretically. The results are applicable to ocean sewer outfall design. Even though the diffuser length may be much greater than the water depth, the flowfield cannot be considered to be two-dimensional. The most important dynamic parameter is a Froude number, F, given by the ratio of the current speed cubed to the buoyancy flux discharged per unit diffuser length. Different mixing regimes can occur depending on the value of F, and the plume can be attached to the lower boundary. Dilution depends on current speed and direction only for F greater than 0.1. For F greater than 0.1, dilution increases with current speed, and diffusers perpendicular to the current will result in greater dilution than if parallel. The surface wastefield spreads rapidly in a parallel current, showing that Y or similarly shaped diffusers are not essential to produce a widely dispersed wastefield. The buoyant spreading of the surface wastefield is a complex phenomenon, having growth laws that change with distance downstream. (Sims-ISWS)
W79-06651

VENICE: SEA-LAGOON EXCHANGE IN A MODIFIED TIDE RANGE,
Consiglio Nazionale delle Richerche, Venice (Italy). Lab. per lo Studio della Dinamica delle Grandi Masse.
For primary bibliographic entry see Field 2L.
W79-06659

EVALUATION OF CONCEPTUAL MODELS FOR DESCRIBING NONEQUILIBRIUM ADSORPTION-DESORPTION OF PESTICIDES DURING STEADY-FLOW IN SOILS,
Florida Univ., Gainesville. Dept. of Soil Science.
For primary bibliographic entry see Field 2G.
W79-06662

FINAL REPORT ON THE BASELINE ENVIRONMENTAL SURVEY OF THE MAFLA LEASE AREAS.
State Univ. System of Florida Inst. of Oceanography, St. Petersburg.
Final Report, April 1978. J. E. Alexander, (Ed.). 200 p, 11 fig, 37 tab. 08550-CT4-11.

Descriptors: *Baseline studies, *Water pollution sources, *Water pollution effects, *Gulf of Mexico, Environment, Resources development, Exploration, Oil, Gases, Chemistry, Biota, Geology, *Outer Continental Shelf, Petroleum development, Mississippi-Alabama-Florida(MAFLA).

In this baseline study, the State University System of Florida, Institute of Oceanography (SUSIO) Consortium's survey was directed and largely restricted to five discrete lease areas on the Mississippi-Alabama-Florida (MAFLA) shelf of the eastern Gulf of Mexico, extending from approximately 89 degrees W, south of Pascagoula, Mississippi, to a tract west of Clearwater, off Tampa Bay, Florida. Existing pollutants in the offshore submerged land area are an important consideration, for in order to make meaningful use of baseline surveys on the shelves one must quantify contaminant levels, as well as be able to determine their origin. The chief objective of this study, as mandated by the Bureau of Land Management, was to sample water, sediments and organisms on the leased tracts before arrival of drilling rigs in mid-summer of 1974. (Sinha-OEIS)
W79-06668

THE RELATIONSHIP BETWEEN BEST MANAGEMENT PRACTICES AND RECEIVING-WATER STANDARDS,
URS Co., Seattle, WA.
G. R. Minton, D. Anderson, and A. Coburn.
Water Resources Bulletin, Vol. 14, No. 6, p 1440-1448, December 1978. 28 ref.

Descriptors: *Nonpoint pollution, *Standards, *Water pollution control, *Management, *Receiving water, *Regulation, Best management practices, Programs, Legislation.

An important enforcement question is, 'What should be the relationship between 'Best Management Practices' (BMP) and receiving-water standards.' Nonpoint pollution discharges are concerned about implementing a BMP program, only to find themselves in violation because receiving-water standards still have not been met. They are also concernd about the procedures a regulatory agency will utilize to determine the relative success of a BMP program. Successful management of nonpoint pollution requires that these concerns be addressed. Three alternative relationships have been developed. The recommended alternative is to implement the BMP program and use standards as a measure of the effectiveness of the program. Failure to achieve the standards would lead to a reevaluation of the BMP program. Enforcement activities against nonpoint dischargers would be restricted to the failure on their part to implement the previously agreed upon BMP program. Recommendations are also made as to measures regulatory agencies should take if their procedures to judge the relative success of a BMP program are to be technically and politically effective. (Bell Graf-Cornell)
W79-06669

SURFICIAL SEDIMENTS,
National Oceanic and Atmospheric Administration, Miami, FL. Atlantic Oceanographic and Meteorological Labs.
G. L. Freeland, and D. J. P. Swift.
MESA New York Bight Atlas Monograph 10. New York Sea Grant Institute Report No NYSSG-AM-78-004, December 1978. 93 p, 11 fig, 2 tab, 116 ref, 64 maps, 2 append.

Descriptors: *Sediments, *Bottom sediments, *Water pollution sources, *Waste disposal, *Water pollution effects, Spoil banks, Outfall sewers, Sewage sludge, Continental Shelf Environmental effects, *Outer Continental Shelf, *New York Bight, *Ocean dumping, Dredge spoil.

The surficial sediment cover of the continental shelf in New York Bight consists of a sheet of sand up to 10 m thick with small areas of gravel and muddy sand. Off the shelf edge, mud increases to become the dominant sediment. Most sediment was first deposited during or soon after the last glacial maxima when the present shelf was land and has been reworked by the advancing shoreline. Most shelf morphologic features also reflect these conditions. Modification of the natural pattern of sedimentation has occurred in the Bight apex where man has dumped his wastes for over 60 years. Dredge spoil dumping has created several knolls

on the bottom, and with outfalls, the dumping of sewage sludge, acid wastes, construction, and other rubble, has made the apex a 'worst case' example of ocean pollution. With proper management of municipal and industrial wastes, however, the apex may eventually return to a near-natural setting--still in use by man, but without harmful ecological effects. (NOAA)
W79-06690

CONTROLLING NONPOINT EXTERNALITIES WITH INPUT RESTRICTIONS IN AN IRRIGATED RIVER BASIN,
Nebraska Univ., Lincoln. Dept. of Agricultural Economics.
G. H. Pfeiffer, and N. K. Whittlesey.
Water Resources Bulletin, Vol. 14, No. 6, p 1387-1403, December 1978. 4 fig, 4 tab, 15 equ, 17 ref. OWRT B-059-NEB (1).

Descriptors: *Nonpoint pollution, *Water pollution control, Economics, Irrigation, *Yakima River Basin(Washington), Linear programming, Simulation analysis, Mathematical models, Sediments, Return flow, Nitrogen, Surface waters.

Irrigated agriculture is a major nonpoint source of surface water quality degradation. Nonpoint source discharges can be controlled by either output taxes or restrictions, or by input taxes or restrictions. The economic theory of externality control with taxes or restrictions on input use is developed. The effectiveness of alternative output control policies in improving surface water quality is demonstrated with a mathematical model of the agriculture and water quality in the Yakima River Basin, Washington. A linear programming model of the farm sector of the Basin in conjunction with a simulation model of environmental quality has been constructed, considering river nitrogen concentration, water temperature, and cropland soil losses. Producer and social abatement costs are the most important measures of policy effectiveness. Sediment loss and river temperature are functionally related to water use. Nitrogen concentration is controlled most efficiently by controlling the use of both fertilizer and water, while sediment and temperature are reduced most efficiently by reducing irrigation water use. (Bell-Graf--Cornell)
W79-06728

REPORT OF COMMITTEE ON GROUND WATER SUPPLIES IN NEW ENGLAND.
For primary bibliographic entry see Field 5G.
W79-06735

RELATIONSHIPS BETWEEN CONCENTRATIONS AND DISCHARGE ON SELECTED ILLINOIS STREAMS,
Northern Illinois Univ., DeKalb. Dept. of Geology.
L. J. Vendl.
Report of Investigations, No. 17, January 1979. 32 p, 8 fig, 2 tab, 37 ref, 1 map.

Descriptors: *Streams, *Water quality, *Illinois, *Watersheds(Basins), Discharge(Water), Data collections, Analytical techniques, Alkalinity, Turbidity, Dissolved solids, Ammonia, Nitrogen, Metals, Iron, Fluorides, Silica, Hydrogen ion concentration, Phosphates, Potassium, Boron, Calcium, Chlorides, Copper, Sulfates, Coliforms, Magnesium, Manganese, Nitrates, Sodium, Total dissolved solids, Barium.

All naturally occurring stream waters contain dissolved materials. By analyzing chemical concentration behavior with respect to discharge, one can begin to answer some major questions concerning the dissolved mineral concentration: (1) What effects do changing discharge conditions have on a chemical constituent's concentration. (2) How do changing seasonal discharges effect concentration of these constituents. (3) What can be said about the source (namely base flow, shallow groundwater, surface runoff, point sources and non-point sources) of the constituent by analyzing the discharge and concentration relationships. In this study, 23 constituents were analyzed using a graphical and descriptive approach in order to answer these questions concerning concentration and water discharge relationships. In an attempt to evaluate the differences between water chemistry, physiography, climate, geology, land use, and drainage characteristics, 4 representative drainage basins were selected for study. These are the Fox River above Algonquin, the Sangamon River above Mahomet, the Little Wabash River above Carmi, and the Big Muddy River above Murphysboro. Most constituents showed a seasonal variation in concentration. Variations in the concentration of each constituent from basin to basin reflect the combination of many factors including the type, magnitude, and sources (such as natural or anthropogenic) of each constituent and the assimilation capacity and discharge conditions of the given stream. (Humphreys-ISWS)
W79-06737

BIOLOGICAL IMPLICATIONS OF METALS IN THE ENVIRONMENT.
Available from the National Technical Information Service, Springfield, VA 22161 as CONF-750 929, Price codes: A99 in paper copy, A01 in microfiche. Report No. ERDA Symposium Series 42, June 1977. Proceedings of Fifteenth Annual Hanford Life Sciences Symposium at Richland, Washington, September 29-October 1, 1975. 691 p, 259 fig, 175 tab, 1344 ref.

Descriptors: *Metals, *Trace elements, *Biochemistry, Animal metabolism, Plant tissues, Soils, Sediments, Water, Water analysis, Water chemistry, Fertilizers, Animal growth, Ecosystems, Foods, Food chains, Heavy metals, Sewage sludge, Land use, Environmental effects, Mathematical models, Adsorption.

Forty papers by scientists engaged in research programs on trace metals in the environmental and biological areas are presented. The metals mercury, platinum arsenic, zinc, copper, lead, cobalt, silver, iron, manganese, and selenium are discussed. The topics covered include uptake of these metals by plants and animals; the forms of trace elements in soils, sediments and water; adsorption of metals; fallout of toxic metals; metal toxicity to a biological system; heavy metal content of vegetable species grown in soil amended with sewage sludge; heavy metal contaminants in fertilizers; trace metals in ecosystems; and the ecological and land-use relationships of toxic metals. A mathematical model to simulate metal uptake by plants growing in soil is presented. Each paper is accompanied by an abstract and list of references; an index is provided. (Davison-IPA)
W79-06787

GROUND-WATER QUALITY IN BANNOCK, BEAR LAKE, CARIBOU, AND PART OF POWER COUNTIES, SOUTHEASTERN IDAHO,
Geological Survey, Boise, ID. Water Resources Div.
For primary bibliographic entry see Field 7C.
W79-06814

EVALUATION AND CORRELATION OF WATER-QUALITY DATA FOR THE NORTH FORK FLATHEAD RIVER, NORTHWESTERN MONTANA,
Geological Survey, Helena, MT. Water Resources Div.
J. R. Knapton.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-292 702, Price codes: A06 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 78-111, November 1978. 95 p, 22 fig, 10 tab, 18 ref.

Descriptors: *Water quality, *Streamflow, *Sediment transport, *Montana, Dissolved solids, Specific conductivity, Trace elements, Evaluation, Regression analysis, Correlation analysis, Computer programs, Baseline studies, Land use, *North Fork Flathead River(Mont), British Columbia, Alberta.

This report is a compilation and evaluation of water-quality measurements that have been made by the U.S. Geological Survey at two stations on the North Fork Flathead River in Montana. Historical streamflow records show an annual mean daily discharge of 3,010 cubic feet per second near the mouth--a threefold increase compared to discharge at the international boundary. The chemical character of the water is dominated by calcium and magnesium cations and the bicarbonate anion. Base flow, in contrast to high flows from runoff, is characterized by higher dissolved constituents and lower concentrations of suspended sediment. The several lakes that contribute water throughout the middle and lower drainage have a dampening effect on both streamflow and constituent concentrations. Using the available data and computer techniques, regression equations were developed between certain water-quality variables. (Woodard-USGS)
W79-06816

METHANE MIGRATION AROUND SANITARY LANDFILLS,
Ohio State Univ., Columbus. Dept. of Civil Engineering.
C. A. Moore, S. R. Igbal, and A. A. Alzoydi.
Journal of the Geotechnical Engineering Division, Proceedings of the American Society of Civil Engineers, Vol. 105, No. GT2, February, 1979. 12 fig, 2 tab, 17 ref, 1 append.

Descriptors: *Computer models, *Methane, *Landfills, *Migration, Groundwater, Water table, Hazards, Explosions, Forecasting, Flow, Gases, Finite element analysis, Charts.

The decomposition of refuse in sanitary landfills results in the generation of methane gas which, when mixed with air, creates an explosion hazard for buildings near landfills. A study was undertaken to develop predictive models for methane migration around landfills using combined transition region multicomponent flow of gases in porous media. A user oriented finite difference code was developed to describe methane migration. Input data consists of landfill geometry, soil type, gases, decomposition history, time steps, program termination, and frequency of printout. The output shows methane concentrations as a function of position. For complex soil configurations, a finite element computer model was developed using axisymmetric geometry and isoparametric elements to define the distribution of soil types. The predictive models have received limited field verification based on data available in the literature. Verification under more controlled conditions is needed to establish reliability of the models. (Purdin-NWWA)
W79-06843

EFFECT OF UPGRADING A MUNICIPAL WASTEWATER EFFLUENT ON POLLUTION INDICATOR AND OTHER MICROORGANISMS IN RIVER WATER,
Connecticut Univ., Noank. Marine Research Lab.
E. A. Matson, S. G. Hornor, and J. D. Buck.
Environmental Science and Technology, Vol. 13, p 460-465, April 1979. 5 fig, 6 tab, 48 ref. OWRT A-052-CONN(19). 14-34-001-9007.

Descriptors: *Microorganisms, *Coliforms, *Yeasts, *Activated sludge, Chlorination, Rivers, *Bioindicators, Municipal wastes, *Sewage treatment, Streptococci, Bacteria, Willimantic/Shetucket River, Connecticut.

Densities of total and fecal coliforms, fecal streptococci, plate count bacteria, and certain yeasts were monitored in an eastern Connecticut watershed for 1 year prior to upgrading a municipal primary settling treatment plant to activated sludge and sampling was continued for 19 months afterward. Substantial reductions in densities of indicator and other bacteria and yeasts upstream of the effluent after upgrading were associated with lower annual precipitation and reduced precipitation-associated sampling. The effluent dilution decreased from 0.84 to 1.42% of river volume due to increased daily treatment plant discharge and decreased river

discharge. Calculated reductions in effluent discharge of indicators ranged from 10% (total coliforms) to 84% (fecal coliforms), while the discharge of 'total plate count bacteria' increased 500%. Chlorination procedures were still required to reduce river total coliform densities below the accepted limit. Within the microbiological perspective, upgrading this treatment plant was of limited value to potential water users. (deLara-Conn)
W79-06856

SOME PROBLEMS IN EVALUATING THE ABILITY OF STRATA TO STORE OR TRANSMIT POLLUTANTS,
Manchester Univ. (England). Dept. of Civil and Structural Engineering.
F. T. Howell.
Water Services, Vol. 82, No. 992, p 668-672, October, 1978. 8 fig, 23 ref.

Descriptors: *Water pollution, *Groundwater, *Migration, *Storage, Aquifers, Permeability, Geologic investigations, On-site investigations, Evaluation, Forecasting, Risks, Pollutants.

Ground water pollution includes any changes in ground water quality which are detrimental to present or future users. If pollutants are placed on, or in the ground, they may migrate or remain in storage depending upon the local hydrogeologic conditions. Problems and errors that occur in the geotechnical investigation, interpretation, and prediction of future changes in these conditions are examined in detail. The consequences of incorrect prediction of the migration or storage properties of strata depend not only upon the magnitude of the error, but also upon the nature of the pollutant and its location in the total environment. In the case of predicting migration, any errors are concerned with the rate of migration, direction, and longevity of the pollution. In the storage situation, the strata or barriers are expected to remain impermeable and prevent the migration of highly toxic fluids. Any activity involving underground pollutants contains an element of risk. However, this must not be used as an excuse to reject proposals concerning pollutants in strata. Nevertheless, it is imperative that decisions are formulated in the full light of the correct appraisal of the ability of the strata to transmit or store pollutants during the lifespan of their effectiveness. (Purdin-NWWA)
W79-06862

AN ENVIRONMENTAL SURVEY OF CANTON ATOLL LAGOON, 1973.
Naval Undersea Center, Kailua, HI. Hawaii Lab.
For primary bibliographic entry see Field 2L.
W79-06881

WATER COMPOSITION AND BIOGEOCHEMICAL GRADIENTS IN THE CANTON ATOLL LAGOON,
Naval Undersea Center, Kailua, HI. Hawaii Lab.
For primary bibliographic entry see Field 2L.
W79-06883

THE ORGANIC DRILLING FLUID CONTROVERSY: PART I,
For primary bibliographic entry see Field 8A.
W79-06897

WATERBORNE DISEASE - A STATUS REPORT EMPHASIZING OUTBREAKS IN GROUND WATER SYSTEMS,
Health Effects Research Lab., Cincinnati, OH.
G. F. Craun.
Ground Water, Vol. 17, No. 2, p 183-191, March-April, 1979. 8 tab, 27 ref.

Descriptors: *Diseases, *Water supply, *Groundwater, Water pollution, Water treatment, Municipal water, Statistics.

Between 1971 and 1977 a total of 192 outbreaks of waterborne disease affecting 36,757 persons were reported in the United States. An etiological agent was determined in only 43% of the outbreaks. Giardiasis was more common in surface water system while Shigellosis occurred more often in ground water systems. More outbreaks occurred in nonmunicipal water systems (70%) than municipal-water systems, however, more illness (67%) resulted from outbreaks in municipal systems. Nearly half of the outbreaks (49%) and illness (42%) were caused by the use of untreated or inadequately treated ground water. Contamination by sewage effluent, primarily from septic tanks or cesspools, was responsible for 42% of the outbreaks and 71% of the illness caused by use of untreated ground water. The major causes of outbreaks in municipal systems were contamination of the distribution system and treatment deficiencies which accounted for 68% of the outbreaks and 75% of the illness occurring in municipal systems. Use of untreated ground water was responsible for only 10% of the municipal system outbreaks and 1% of the illness. Inadequate and interrupted treatment or lack of treatment of ground water sources were responsible for 78% of the outbreaks and 94% of the illness in nonmunicipal-water systems. (Purdin-NWWA)
W79-06909

HEAVY METAL CONTAMINATION OF SURFACE WATERS AND FISH FLESH IN SOUTH CAROLINA,
Clemson Univ., SC. Dept. of Environmental Systems Engineering.
A. R. Abernathy.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-296 215, Price codes: A07 in paper copy, A01 in microfiche. Water Resources Research Institute, Clemson University, Report No. 74, March 1979. 119 p, 6 fig, 29 tab, 120 ref, 3 append. OWRT A-032-SC(4).

Descriptors: *Heavy metals, Water pollution effects, Mercury, Cadmium, Arsenic, Reservoirs, *Surface water, *Fish, South Carolina, Lake Keowee, Lake Jocassee.

A study was made from July 1974 to June 1976 of the major reservoirs in South Carolina for mercury, cadmium, and arsenic in water, sediments, and fish flesh. Mercury was found to exceed the FDA action level of 0.5 ppm in flesh of fish taken from Lakes Keowee and Jocassee. Most fish from other waters had concentrations of mercury lower than 0.5 ppm. No unusual concentrations of mercury were found in water or sediments. Local concentrations of cadmium were found in a stream receiving plating wastewater, but no other problems of high concentrations of cadmium or arsenic were located.
W79-06914

SIZE DEPENDENT MODEL OF HAZARDOUS SUBSTANCES IN AQUATIC FOOD CHAIN,
Manhattan Coll., Bronx, NY.
R. V. Thomann.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-281 009, Price codes: A04 in paper copy, A01 in microfiche. Report No. EPA-600/3-78-036, April 1978. 48 p, 11 fig, 7 tab, 45 ref. R803680030.

Descriptors: *Path of pollutants, *Food chains, *Water pollution, *Mathematical models, Ecosystems, Aquatic animals, Aquatic habitats, Equations, Analytical techniques, Tracking techniques, Ecology, Food webs, Lake Ontario, Wastes.

A mass balance model using organism size as an independent variable is constructed to track bioaccumulation of toxic substances in freshwater ecosystems and subsequent transfer up the food chain. Since this model represents size dependent ecological continuum, classical compartment analyses becomes a special case. Size dependence is viewed as an approximate ordering of trophic position. To illustrate this theory the analysis of some PCB data in Lake Ontario was used with a completely mixed water volume; PCB data on net plankton, alewife, smelt, sculpin and coho salmon were used. Preliminary estimates of the model coefficients were made with the field data and laboratory data from the literature. The results indicated that about 30% of the observed 6.5 micrograms of PCB/gram fish at the coho salmon size range was due to transfer from lower levels in the food chain and about 70% was due to direct water intake. The rapid accumulation of PCB with organism size as shown by the model, was due to decreased excretion rates and decreased biomass at higher trophic levels. It is concluded that this equation permits rapid solution for the distribution of the toxicant throughout the food chain, but the present form of the size dependent model does not permit detailed analysis on any one segment of the ecosystem. (Davison-IPA)
W79-06954

INDUSTRIAL PROCESS PROFILES FOR ENVIRONMENTAL USE: CHAPTER 9. THE SYNTHETIC RUBBER INDUSTRY,
Radian Corp., Austin, TX.
J. Parr, T. B. Parsons, and N. P. Phillips.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-281 480, Price codes: A05 in paper copy, A01 in microfiche. Report EPA-600/2-77-023i, 1977. 92 p, 3 fig, 45 tab, 50 ref, 3 append.

Descriptors: *Industrial wastes, *Synthetic rubber, *Organic compounds, *Water pollution sources, *Organic wastes, Chemical wastes, Industrial water, Operations, Industrial production.

The environmental impacts of the synthetic rubber industry are examined. Emulsion crumb production processes are described including: monomer storage, caustic wash, polymerization, light monomer recovery, heavy monomer recovery, coagulation and screening, and crumb washing, drying, and finishing. Latex production processes are described including polymerization, light monomer removal, heavy monomer removal, and blending, storage, and shipping. Solution crumb production processes include feed drying, polymerization, cement storage, stripping and coagulation, monomer and solvent recovery, and dewatering and product finishing. The largest source of pollution is aqueous emissions. Some organic compounds identified in effluents from synthetic rubber plants are 2, benzothiazole, n-butylisothiocynate, bis-2-chloroethyl-ether, p-dithiane, styrene, and triethylurea. (Small-FRC)
W79-06959

INDUSTRIAL PROCESS PROFILES FOR ENVIRONMENTAL USE: CHAPTER 12. THE EXPLOSIVES INDUSTRY,
Radian Corp., Austin, TX.
C. E. Hudak, and T. B. Parsons.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-291 641, Price codes: A06 in paper copy, A01 in microfiche. Report EPA-600/2-77-023L, 1977. 125 p, 12 fig, 38 tab, 19 ref, 3 append.

Descriptors: *Industrial wastes, *Water pollution sources, *Explosives, *Waste water, *Organic compounds, Chemical wastes, Air pollution, Solid wastes.

The environmental impacts of the explosive industry are discussed. The explosives industry includes companies which manufacture organic nitration products and formulate mixtures of chemicals with explosive properties. Five nitration processes are described: TNT production processes, Nitrocellulose production processes, RDX/HMX production processes, Nitroglycerin production processes, and Pentaerythritol Tetranitrate production processes. Also, the production of nitric acid is described. Liquid wastes from these processes contain various significant pollutants and potential pollutants. Six process flow charts and fifteen process descriptions are presented to characterize the industry. Input materials, operating parameters, utility requirements, and waste streams are described. In addition to waste water problems, air pollution and solid waste disposal problems are considered. (Small-FRC)
W79-06960

INDUSTRIAL PROCESS PROFILES FOR ENVIRONMENTAL USE: CHAPTER 13. PLASTICIZERS INDUSTRY,
Radian Corp., Austin, TX.
C. M. Thompson.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-291 642, Price codes: A04 in paper copy, A01 in microfiche. Report EPA-600/2-77-023m, 1977. 84 p, 3 fig, 15 tab, 22 ref, 3 append.

Descriptors: *Industrial wastes, *Plastics, *Waste water, *Biochemical oxygen demand, *Suspended solids, Chemical oxygen demand, Copper, Oil, Carbon, Chlorides, Waste water treatment.

The environmental impacts of the plasticizer industry are catalogued including the activities of manufacturers who produce primary synthetic organic plasticizers. Three process flow sheets and three process descriptions characterize the industry. Data are presented on input materials, operating parameters, utility requirements, and waste streams. The synthetic plasticizer processes detailed are: esterification of carboxylic acids, production of phosphate esters by esterification, and epoxidation. Waste water is the major environmental problem. Waste water from esterification of carboxylic acids can contain dilute caustic, additives, sulfates, and organics such as alcohols, monoester, and small amounts of product. A tricresylphosphate plant had a higher waste water flow and much lower loadings for biochemical oxygen demand, chemical oxygen demand, total organic carbon, cyanide, oil, copper, and total dissolved solids, than those for a diethylphthalate plant. Sulfate loads were comparable for the two processes, and chloride loads were high for the tricresylphosphate process. Problems can be avoided with proper waste water treatment. (Small-FRC)
W79-06961

INDUSTRIAL PROCESS PROFILES FOR ENVIRONMENTAL USE: CHAPTER 11. THE SYNTHETIC FIBER INDUSTRY,
Radian Corp., Austin, TX.
J. L. Parr.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-281 481, Price codes: A04 in paper copy, A01 in microfiche. Report EPA-600/2-77-023k, 1977. 56 p, 1 fig, 22 tab, 68 ref, 3 append.

Descriptors: *Textiles, *Industrial wastes, *Waste water, *Solvents, *Lubricants, Sewage, Cooling water, Organic compounds, Waste water treatment, Industrial production.

The environmental impacts of the synthetic fibers industry are examined. Fiber processes are described including: melt spinning, wet spinning, dry spinning, lubrication, drawing, and fiber modifications. Liquid emissions represent the largest potential source of pollutants. These are generally spin-finish wastes and include water used for purging the spinning baths and washing the filaments, lubricants used in finish applications, and solvent wastes from dry and wet spinning. There are also sanitary wastes resulting from the large number of employees, and cooling water blowdown. Waste water emissions are classified according to waste load and treatability. Analysis of samples from a settling pond at an acrylic fibers production facility determined the presence of acrylonitrile (100 mg/liter), 2,8-dibromo-1-propanol (0.5 mgl/liter), an isomer of dibromopropene, and 2,4-dimethyldiphenyl-sulfone. (Small-FRC)
W79-06962

INDUSTRIAL PROCESS PROFILES FOR ENVIRONMENTAL USE: CHAPTER 19. THE CLAY INDUSTRY,
Dow Chemical Co., Freeport, TX.
J. T. Reding, K. E. Bishop, P. E. Muehlberg, and B. P. Shepherd.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-281 486, Price codes: A04 in paper copy, A01 in microfiche. Report EPA-600/2-77-023s, 1977. 61 p, 3 fig, 6 tab, 29 ref, 3 append.

Descriptors: *Industrial wastes, *Clays, Water pollution sources, *Settling basins, *Suspended solids, Solid wastes, Air pollution, Industrial production, Operations, *Mining.

The environmental impacts of the clay industry are discussed, and industrial processes are described. Clay production and brick manufacture are considered separately. One chemical tree, two process flow sheets, and nine process descriptions characterize the industry. The process descriptions are: mining, crushing, drying, dry grinding, wet concentrating, final drying, extruding, brick drying, and firing. Water pollution is a major environmental problem. As overburden is removed and clay is mined, water percolates through the soil. It becomes high in suspended solids and is usually discharged into nearby streams. A sump or settling basin for the percolating water can solve the problem. Dust emissions are a minor problem. Generated solid wastes are largely used for landfill. In 1973 kaolin clay mining generated approximately 30,000,000 to 40,000,000 metric tons of waste, while common clay mining generated 10,000,000 to 15,000,000 metric tons of waste. (Small-FRC)
W79-06963

INDUSTRIAL PROCESS PROFILES FOR ENVIRONMENTAL USE: CHAPTER 2. OIL AND GAS PRODUCTION INDUSTRY,
Radian Corp., Austin, TX.
For primary bibliographic entry see Field 5A.
W79-06984

INDUSTRIAL PROCESS PROFILES FOR ENVIRONMENTAL USE: CHAPTER 7. ORGANIC DYES AND PIGMENTS INDUSTRY,
Radian Corp., Austin, TX.
T. R. Steadman, E. W. Helper, T. Parsons, G. E. Wilkins, and N. P. Phillips.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-281 479, Price codes: A16 in paper copy, A01 in microfiche. Report EPA-600/2-77-023g, 1977. 362 p, 76 fig, 7 tab, 5 append.

Descriptors: *Dyes, *Organic compounds, *Pigments, *Industrial production, *Toxicity, Effluent streams, Solid wastes, Air pollution, Brines, Acids, Alkalis(Bases), Color, Metals, Catalysts, Chemical reactions, Waste water disposal, Industrial wastes, Chemical wastes.

Processes associated with the organic dyes and pigments industry are described and their waste streams are characterized. The processes generate solid, liquid, and gaseous wastes. Large volumes of toxic liquid wastes originate from chemical reaction by-products; physical separation techniques such as crystallization, filtration, and washing; and from equipment cleaning methods. The effluent streams are composed of brine solutions and dilute acids and bases contaminated with toxic and/or explosive organic compounds of highly colored dyes or intermediates. Metals or metal salts used as catalysts for various reactions are also present in the waste waters. Specific composition of the effluents is dependent upon the dye or pigment being manufactured. The high cost of treating and controlling these wastes has caused some companies to terminate production of some dyes and pigments. Gaseous emissions generated by this industry include nitrogen oxides, sulfur oxides, hydrogen sulfide, hydrogen chloride, and organic vapors such as amines, phosgene, and formaldehyde. Solid wastes generated include distillation residues, particulates from baghouses, filter paper, and activated carbon. Forty-two chemical trees, 34 process flow sheets, and 48 process descriptions were prepared. Company, product, and raw material data are also included. (Lisk-FRC)
W79-06985

INDUSTRIAL PROCESS PROFILES FOR ENVIRONMENTAL USE: CHAPTER 10. PLASTICS AND RESINS INDUSTRY,
Radian Corp., Austin, TX.
G. F. Wilkins.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-291 640, Price codes: A15 in paper copy, A01 in microfiche. Report EPA-600/2-77-023j, 1977. 351 p, 22 fig, 121 tab, 84 ref, 3 append.

Descriptors: *Plastics, *Resins, *Chemical wastes, *Industrial production, *Pollutant identification, *Organic compounds, Effluent streams, Air pollution, Cooling towers, Boilers, Solid wastes, Waste water treatment, Industrial wastes.

Processes, operations, and wastes of the plastics and resins industry are detailed. The industry converts monomer or chemical intermediate materials into resinous polymer products. The report includes 20 process flow sheets, and 60 process descriptions incorporating data on input materials, operating parameters, utility requirements, and waste streams. Aqueous waste streams originate from processing streams which are in direct contact with water; from chemical reactions; from cleaning process equipment, area maintenance, utility boilers, and cooling water blowdown; and laboratories. Pollutants found in the waste waters include organic reactants, monomers, oligomers, polymers, and salts. Gaseous emissions are primarily hydrocarbons and specifically, vinyl chloride, toluene disocyanate, phosgene, pyridine, olefins, aromatics, paraffins, and naphthenes. Solid wastes, such as captured particulates and fines, and plastic wastes, are landfilled, incinerated, or recycled. Waste waters produced by cooling towers, refrigeration, and steam generation facilities, may contain toxic anti-corrosion chemicals such as chromium compounds and anti-fouling agents; these effluent streams are usually combined for discharge to treatment plants. (Lisk-FRC)
W79-06986

INDUSTRIAL PROCESS PROFILES FOR ENVIRONMENTAL USE: CHAPTER 26. TITANIUM INDUSTRY,
Radian Corp., Austin, TX.
V. S. Katari, and T. W. Devitt.
Report EPA-600/2-77-023z, 1977. 65 p, 2 fig, 21 tab, 50 ref, 3 append.

Descriptors: *Titanium, *Industrial production, *Effluent streams, *Mine wastes, *Industrial wastes, Sludge disposal, Acidity, Neutralization, Waste treatment, Sulfur compounds, Operations.

An analysis of the titanium industry producing titanium metal and titanium dioxide is presented. Two industrial process flow sheets and 11 process descriptions incorporating data on input materials, operation parameters, utility requirements, and waste streams were prepared to characterize the titanium industry. The industry generates large quantities from the mining and concentrating of titanium and the production of titanium dioxide. The wastes consist primarily of weak sulfuric acid and their disposal represents a major environmental problem. The wastes are disposed of by sea dumping after neutralization treatment. In 1972, US titanium dioxide plants produced about 1.7 million metric tons of iron-acid sludge and 146 thousand metric tons of iron-chloride sludge. Particulate emissions are also associated with the titanium industry. The mining and beneficiation of ilemenite and the production of titanium dioxide pigment result in emissions. Sulfur dioxide mist, particulate emissions, or chloride emissions are generated by the various calcination processes. (Lisk-FRC)
W79-06987

FATE OF BIOLOGICALLY ACCUMULATED COPPER IN GROWING AND DECOMPOSING THALLI OF TWO BENTHIC RED MARINE ALGAE,
Fundacao Univ. do Rio Grande (Brazil). Base Oceanografica Atlantica.
U. Seeliger, and P. Edwards.
Journal of the Marine Biological Association of the United Kingdom, Vol. 59, No. 1, p 227-238, 1979, 3 fig, 1 tab, 42 ref.

Descriptors: *Environmental effects, *Path of pollutant, Pollutants, Copper, Algae, Absorption, Uptake(Biological), Marine animals, Food chains.

In order to investigate uptake and subsequent release of Cu by both living and decompising thalli, Ceramium pedicellatum and Neogardhiella baileyi were cultured for 30 days in 1.4, 6.4 and 11.4 microg/l Cu in dissolved inorganic form. Concentration factors of Cu found in thalli ranged from 4540 (N. baileyi in 6.4 microg/l) to 6864 (C. pedicellatum in 1.4 microg/l). Up to 22% of the Cu in the thalli was bound to dissolved organic sites during dissolved organic matter (DOM) release while only 3-10% was released in the dissolved inorganic form. After 100 days of degradation, under axenic conditions with no bacterial activity occurring, 80-90% of the Cu was associated with organic dissolved or particulate fractions. It was concluded that the majority of Cu incorporated into the living algal thallus will eventually become available to marine consumers. (Chilton-ORNL)
W79-06988

INDUSTRIAL PROCESS PROFILES FOR ENVIRONMENTAL USE: CHAPTER 6. THE INDUSTRIAL ORGANIC CHEMICALS INDUSTRY,
Research Triangle Inst., Research Triangle Park, NC.
R. Liepins, F. Mixon, C. Hudak, and T. B. Parsons.
Report EPA-600/2-77-0231, 1977. 1014 p, 20 fig, 12 tab, 600 ref, 5 append.

Descriptors: *Environmental effects, *Chemical industry, *Chemical wastes, *Evaluation, *Water pollution sources, Organic compounds, Waste water.

The environmental impacts of the industrial organic chemicals industry are presented. The industry is considered in terms of ten feedstock groups: benzene, butylenes, sources of cresylic acids, ethylene, methane, naphthalene, paraffins, propylene, toluene, and xylene. Ten chemical trees, ten process flow sheets, and 365 process descriptions characterize the industry. Within each process description, available data are presented on function, input materials, operating parameters, utilities, waste streams, EPA Source Classification Code, and references. Company, product, and raw material data are included as appendices. (Small-FRC)
W79-06989

INDUSTRIAL PROCESS PROFILES FOR ENVIRONMENTAL USE: CHAPTER 15. BRINE AND EVAPORITE CHEMICALS INDUSTRY,
Radian Corp., Austin, TX.
P. E. Muehlberg, B. P. Shepherd, J. T. Redding, and H. C. Behrens.
Report EPA-600/2-77-0230, 1977. 324 p, 24 fig, 8 tab, 150 ref, 3 append.

Descriptors: *Environmental effects, *Chemical industry, *Chemical wastes, *Brines, *Inorganic compounds, Water pollution sources, Waste water, Sea water, Saline lakes.

The environmental impacts of the brine and evaporative chemicals industry were evaluated. The industry encompasses all first-level inorganic compounds derived from subterranean brines, from existing or historic salt lakes, and from sea water. Six segments of the industry are discussed: borax and borix acid, chlorine-caustic, lithium chemicals, magnesium chemicals, potash, and sodium metal. The industry is characterized by one chemical tree, 22 process flow sheets, and 67 process descriptions. Within each process description, input materials, operating parameters, utility requirements, and waste streams are described. Company, product, and raw material data are included as appendices. (Small-FRC)
W79-06990

RESULTS OF AN ALGAL TOXICITY TEST APPLIED TO SEDIMENT ELUTRIATES,
Naval Research Lab., Washington, DC.
P. J. Hannan, and C. E. Patouillet.
NRL Memorandum Report 3952, 1979. 24 p, 2 fig, 8 tab, 23 ref.

Descriptors: *Sediments, *Toxicity, *Algae, *Growth rates, *Eluvium, Water pollution, Laboratory tests, Copper.

The effect of sediments from various marine and estuarine sites on the growth rate of the alga, Phaeodactylum tricornutum, was investigated. Cultures were grown in solutions of one part Guillard and Ryther medium and 11 parts sediment elutriate. Algae growth was monitored by fluorescene measurements over a 2-day period. Generally, there was a prolongation of the lag phase of growth, and there were a few cases in which the elutriates were highly toxic. The concentration of the inoculum was a factor in the algae response. With a heavy inoculum (over 30 ppm packed cell volume), a group of sediment elutriates promoted growth, but in the presence of very dilute inocula, these same elutriates provided less growth than the controls. Some sediment elutriates did not reduce the toxicity of sublethal concentrations of Cu(+2), while others did. Also, prolonged storage of sediments at refrigerator temperatures decreased the capacity of certain sediments to reduce the toxicity of Cu(+2) when combined with elutriates. Variations in toxicity were demonstrated in sediments with close proximity to each other in Puerto Misquito Bay, Puerto Rico. (Small-FRC)
W79-06992

5C. Effects Of Pollution

LAKE SUPERIOR ORGANIC CARBON BUDGET,
Minnesota Univ., Minneapolis. Dept. of Civil and Mining Engineering.
W. J. Maier, and W. R. Swain.
Water Research, Vol 12, No 6, p 403-412, 1978. 6 fig, 4 tab, 19 ref. B-139-MINN(1). 14-34-0001-8092.

Descriptors: *Lake Superior, *Great Lakes, *Organic carbon, *Nutrient budgets, *Mathematical models, *Water pollution sources, *Water quality indices, Lakes, Carbon, Total organic carbon, Mass balance, Model studies, Indicators, Nutrients, Photosynthesis, Watersheds(Basins), Rainfall, Sedimentation, Precipitation(Atmospheric), Runoff, Primary productivity, Surface runoff coefficient, Industrialization, Urbanization, Fallout, Air pollution effects.

Analysis of the organic carbon budget for Lake Superior with a simple mathematical model treating the lake as a well-mixed basin shows that watershed runoff, precipitation, and in-situ photosynthetic production are major sources of inflow that could ultimately lead to significant deterioration of water quality. Large yearly inflows of organic matter, whose effect on total organic carbon (TOC) concentration is muted because of dilution in the large lake, could become significant in the long run with persistent small increases which are difficult to verify experimentally. Should industrialization double runoff coefficients, yearly TOC increase would be less than 0.05 mg/l, but lake concentration could reach gross pollution levels (five mg/l) in less than 70 years. Influx of organic matter from watershed drainage is described in this study in terms of surface area and a surface runoff coefficient (SROC) characterized by topographical-hydrological factors and the level of industrial-urban activity. The St. Louis River waterahed has the highest SROC (7.5 g/sq m/yr), while undeveloped watersheds have SROCs of 3.4-5.0 g/sq m/yr. TOC influx from the atmosphere as rainfall or dry fallout is probably low (0-3 mg/l) at present, but an increase to 9.4 mg/l (typical of industrial areas) would increase the lake's carbon burden by an amount equal to the tributary runoff associated with an SROC of five gm/sq m/yr. Net yearly accumulation of organic carbon from photosynthetic primary production is undoubtedly small. (Lynch-Wisconsin)
W79-06504

ENVIRONMENTAL ASSESSMENT OF THE ALASKAN CONTINENTAL SHELF. QUARTERLY REPORTS OF PRINCIPAL INVESTIGATORS JULY - SEPTEMBER 1978, VOLUME I.
December 1978. 504 p, NOAA, Environmental Research Laboratories, Boulder, CO. Outer Continental Shelf Environmental Assessment Program.

Descriptors: *Baseline studies, *Alaska, *Resources development, *Water pollution effects, *Environmental effects, Mammals, Birds, Fish, Microbiology, Ecosystems, *Outer Continental Shelf, *Ecological distribution, Receptors, Petroleum development, Quarterly reports.

Quarterly reports delineate objectives and progress in baseline studies designed to assess the environmental impact of resources development on Alaska's Outer Continental Shelf. Emphasis is on organizing ecological distributions. (See also W79-06511) (Sinha-OEIS)
W79-06510

ENVIRONMENTAL ASSESSMENT OF THE ALASKAN CONTINENTAL SHELF. QUARTERLY REPORTS OF PRINCIPAL INVESTIGATORS JULY - SEPTEMBER 1978. VOLUME II.
For primary bibliographic entry see Field 5B.
W79-06511

ENVIRONMENTAL ASSESSMENT OF THE ALASKAN CONTINENTAL SHELF. QUARTERLY REPORTS OF PRINCIPAL INVESTIGATORS OCTOBER - DECEMBER 1978. VOLUME I.
March 1979. 628 p, NOAA, Environmental Research Laboratories, Boulder, CO. Outer Continental Shelf Environmental Assessment Program.

Descriptors: *Baseline studies, *Alaska, *Resources development, *Environmental effects, *Water pollution effects, Mammals, Birds, Fish, Microbiology, Ecosystems, *Outer Continental Shelf, Receptors, Petroleum development, Quarterly reports.

This volume contains numerous brief quarterly reports of work in progress or planned which examines the environmental effects of various activities and developments on the Outer Continental Shelf of Alaska with respect to - receptors such as marine mammals, birds, fish and microbiology. Studies on specific effects and contaminant baselines are encompassed. (See also W79-06513) (Sinha-OEIS)
W79-06512

ENVIRONMENTAL ASSESSMENT OF THE ALASKAN CONTINENTAL SHELF. QUARTERLY REPORTS OF PRINCIPAL INVESTIGATORS OCTOBER - DECEMBER 1978. VOLUME II.
For primary bibliographic entry see Field 5B.
W79-06513

PASSAGE OF ANTICYCLONIC GULF STREAM EDDIES THROUGH DEEPWATER DUMPSITE 106 DURING 1974 AND 1975,
National Marine Fisheries Service, Narragansett, RI. Atlantic Environmental Group.
For primary bibliographic entry see Field 5B.
W79-06514

NATURAL GAS SEEPAGE ON THE SOUTH TEXAS SHELF,
Texas A and M Univ., College Station.
For primary bibliographic entry see Field 5B.
W79-06517

BIOGENIC AND THERMOGENIC GAS IN GAS-CHARGED SEDIMENT OF NORTON SOUND, ALASKA,
For primary bibliographic entry see Field 5B.
W79-06518

AT-SEA DISCHARGE OF OCEAN MINING PROCESS REJECTS - AN ALTERNATIVE TO LAND DISPOSAL,
For primary bibliographic entry see Field 5B.
W79-06519

A COLLISION AVOIDANCE SYSTEM FOR OFFSHORE OPERATIONS,
For primary bibliographic entry see Field 5B.
W79-06520

ECOLOGICAL INVESTIGATIONS OF PETROLEUM PRODUCTION PLATFORMS IN THE CENTRAL GULF OF MEXICO - PRELIMINARY FINDINGS,
C. A. Bedinger, Jr.
In: Proceedings of Eleventh Annual Offshore Technology Conference, held Houston, TX, April 30-May 3, 1979. Volume 4, p 2149-2161, 6 fig, 5 tab, 13 ref, OTC No 3605. Offshore Technology Conference, Dallas, TX 1979.

Descriptors: *Ecology, *Offshore platforms, *Water pollution effects, *Gulf of Mexico, Environmental effects, Oil pollution, *Outer Continental Shelf, Petroleum development.

Southwest Research Institute is presently managing a relatively large program in offshore ecology for the Bureau of Land Management. Project objectives are to assess the long term cumulative effects of production platform operation on the Outer continental shelf (OCS) environment, and further define their 'artificial reef' effect. These results are then to be used in helping formulate future research on the OCE, indicate monitoring techniques and, to review present 'benchmark' studies. The study area covers a broad expanse of the Louisiana 'oilpatch' from the Mississippi delta, west 200 miles and offshore 100 miles. Twenty-four stations have been visited during late spring and late summer, 1978, and winter, 1979, with four platforms sampled as primary sites during each season, 16 as secondary sites in the late summer and four controls in each season. The program was designed to cover all production types, ages and surrounding ecosystems normal to the northcentral Gulf of Mexico. Collections and analyses have included basic hydrography; hydrocarbons in water, sediments and biota; trace metals from similar samples; sediment physical characterization; benthic microbiology; benthic biota; histopathology in fish and invertebrates; and platform associated fouling organisms and fish. This paper presents data from initial sampling and gives observations of trends. The major observations realized are that the Mississippi River overshadows man's activities in affecting the environment in that it overrides ocean water over a considerable area in the nearshore during the summer months causing an oxygen decline and subsequent dieoff and emigration of organisms. (Sinha-OEIS)
W79-06521

AN INDEPENDENT APPRAISAL OF THE OFFSHORE ECOLOGY INVESTIGATION,
M. E. Bender, J. M. Sharp, D. J. Reish, S. G. Appan, and C. H. Ward.
In: Proceedings of Eleventh Annual Offshore Technology Conference, held Houston, TX, April 30-May 3, 1979. Volume 4, p 2163-2172, 6 fig, 4 tab, 11 ref, Oct No 3606. Offshore Technology Conference, Dallas, TX 1979.

Descriptors: *Monitoring, *Ecology, *Louisiana, *Water pollution effects, *Oil pollution, Environmental effects, Resources development, Baseline studies, Gas, Drilling, *Outer Continental Shelf, Petroleum development, Oil and gas production.

The Offshore Ecology Investigation (OEI) was conducted over a two-year (June 1972 - January 1974) eight-season period in the Timbalier Bay and offshore region of the 'Louisiana Oil Patch'. It consisted of 23 biological, chemical, physical, and geological investigations coordinated in space and time in an effort to detect any cumulative effects on the bay and offshore ecosystems resulting from 35 years of intensive oil and gas drilling and production. The individual Principal Investigators' data, reports, and conclusions were synthesized and interpreted by a four-member Council. During the past year, the logic and rationale employed and the data and conclusions drawn for the OEI were evaluated by three environmental scientists who were not involved in the conduct of the study. The evaluation was conducted using computer-assisted methods which permitted unconstrained and completely selective access to, and display of, all of the OEI data. This paper presents the results of that analysis in terms of (1) the validity and the adequacy of the data to support the 1974 OEI consensus conclusions, (2) the validity of, and basis for, those conclusions, and (3) general recommendations for monitoring methodologies. (Sinha-OEIS)
W79-06522

AN INTRODUCTION TO THE OILSPILL RISK ANALYSIS MODEL,
For primary bibliographic entry see Field 5B.
W79-06523

THE MIXING OF OIL SPILLS INTO THE SEA BY BREAKING WAVES,
A. Naess.
In: Proceedings of Eleventh Annual Offshore Technology Conference, held Houston, TX, April 30-May 3, 1979. Volume 4, p 2193-2204, 11 fig, 2 tab, 9 ref, OCT No 3610. Offshore Technology Conference, Dallas, TX 1979.

Descriptors: *Oil spills, *Waves(Water), *Mixing, *Model studies, Resources development, Environmental effects, Water pollution effects, Baseline studies, *Outer Continental Shelf, Petroleum development.

A problem of considerable importance to pollution control out on the high seas is the mixing of an oil spill into the sea caused by breaking waves. In this paper a theoretical model is proposed that represents a fruitful approach to the problem of determining the amount of oil mixed into the sea by breaking waves. The model is based primarily on probabilistic methods, but with experimental observations and data as an essential foundation. In order to illustrate the theoretical model, some numerical examples are given. (Sinha-OEIS)
W79-06525

SOME CAUSES, CONSEQUENCES AND POTENTIAL ENVIRONMENTAL IMPACTS OF OXYGEN DEPLETION IN THE NORTHERN GULF OF MEXICO,
N. Fotheringham, and G. H. Weissberg.
In: Proceedings of Eleventh Annual Offshore Technology Conference, held Houston, TX, April 30-May 3, 1979. Volume 4, p 2205-2208, 4 fig, 1 tab, 2 ref, OTC No 3611. Offshore Technology Conference, Dallas, TX 1979.

Descriptors: *Water quality, *Water pollution effects, *Gulf of Mexico, Oil pollution, Waste disposal, Mortality, Benthos, Environmental effects, Resources development, Baseline studies, *Outer Continental Shelf, *Oxygen depletion, Ocean dumping.

Biological and water quality changes in the Gulf of Mexico off the central Louisiana coast have been examined during a seasonal period of stratification and oxygen depletion in the water column. Probable causes, observed effects, and potential impacts on the timing of ocean discharges and dumping and onsite selection for offshore industries are described. Apparently an annual phenomenon of variable intensity resulting from a large discharge of low salinity, organic-laden water from the Mississippi and Atchafalaya Rivers at a time of minimal vertical mixing, this midsummer event may be intensified and prolonged by the intrusion of high salinity bottom water from a Loop Current eddy. In 1978, a widespread low oxygen layer occupied the lower 3 to 8 m of the 6 to 17 m water column for at least 3 weeks. Dissolved oxygen concentration was commonly less than 0.1 ppm in this layer, resulting in the mortality of some polychaetes, mollusks, and crustaceans, including blue crabs, and in the reduction of demersal shrimp and fish populations, probably through emigration offshore. Numerous large bivalves approximately 4 to 5 years old were killed, indicating an intensity not experienced since 1973 to 1974, when Green found anoxic bottom water at over one-half of his stations in this area. The temporal and geographic distribution of this condition and its environmental consequences should be recognized by industries engaged in fishing, offshore petroleum production, and offshore dumping and by government agencies providing leases and permits for these activities. (Sinha-OEIS)
W79-06526

A SEA-FLOOR SEISMIC MONITORING NETWORK AROUND AN OFFSHORE OILFIELD PLATFORM AND RECORDING OF THE AUGUST 13, 1978 SANTA BARBARA EARTHQUAKE,
University of Southern California, Los Angeles.
For primary bibliographic entry see Field 5B.
W79-06528

ENVIRONMENTAL HAZARDS: CONSIDERATIONS FOR OUTER CONTINENTAL SHELF DEVELOPMENT,
For primary bibliographic entry see Field 5B.
W79-06529

TEMPERATURE TOLERANCE OF LARVAL MUSKELLUNGE (ESOX MASQUINONGY MITCHELL) AND F1 HYBRIDS REARED UNDER HATCHERY CONDITIONS,
State Univ. of New York Coll. at Buffalo. Dept. of Biology.
J. D. Bonin, and J. R. Spotila.
Comparative Biochemistry and Physiology, Vol. 59A, No. 3, p 245-248, 1978, 2 fig, 31 ref. ERDA E(11-1)-2502.

Descriptors: *Environmental effects, *Temperature, *Resistance, Fry, Larval growth stage, Fish, Pikes, *Critical thermal maxima.

Muskellunge and norlunge fry were acclimated to as close to natural conditions as possible in lake water with natural diets and photoperiod. Temperature tolerances of the fry were determined during a 53 day period beginning the day after hatching and ending when fry were released to Chautauqua Lake. There was a highly significant difference between the average critical thermal maxima (CTM) of norlunge (34.0C) and muskellunge (32.8C) fry. Both fish exhibited a marked decrease in CTM during swim-up indicating that this is a critical period of development. After swim-up the temperature tolerance of muskellunge fry gradually increased. CTM of norlunge fry followed the same pattern but were higher than those of muskellunge fry. CTM increased in both fry regardless of water temperature. Norlung fry adjusted to changing environmental conditions more readily than muskellunge fry. (Chilton-ORNL)
W79-06530

EFFECTS OF THERMAL LOADING ON BOTTOM INVERTEBRATES IN A SOUTH CAROLINA RESERVOIR,
Clemson Univ., SC. Dept. of Zoology.
C. F. Sigmon.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-294 404, Price codes: A03 in paper copy, A01 in microfiche. Water Resources Institute, Clemson University, Completion Report No. 76, April 1979. 40 p, 5 fig, 7 tab, 35 ref. OWRT B-086-SC (1).

Descriptors: *Benthos, *Heated water, *Water pollution, *Density, *Distribution, *Water pollution effects, Benthic flora, Benthic fauna, Aquatic life, Nuclear reactors, Nuclear powerplants, Temperature, Sampling, Oconee Nuclear Station, Lake Keowe(South Carolina).

The influence of season, depth, station location, water temperature and sediment characteristics on benthos were studied in an investigation of the

effects of operation of the Oconee Nuclear Station in Lake Keowee, South Carolina. The study period, 1971-1976, includes a two year time prior to the start-up of the Station's three 886 megawatt reactors during 1973 and 1974, and the years of intermittant operation of all three reactors. Sediment samples taken at one and 10 m depths at the four stations were analyzed for particle size distribution, benthic samples were collected monthly at the stations, and temperature data was obtained from monitors operated at each station by Duke Power Company. The results include data on species composition, density and headwidths of benthos. During the study period, diversity and density were lower in the discharge canal. Both were caused by reduced organic content of the discharge canal sediments. Temperature did not affect density or diversity, and subtle effect of temperature on growth were not observed. It is concluded that the distribution of those benthos studied is more strongly influenced by sediment characteristics than by temperature. The hypolimnetic intake design aids in minimizing the effects of the thermal effluent on the benthos. The thermal character of the discharge canal does not differ much from that of the epilimnion of the other stations. (Davison-IPA)
W79-06561

KEPONE/MIREX/ HEXACHLOROCYCLOPENTADIENE: AN ENVIRONMENTAL ASSESSMENT.
National Research Council, Washington, DC.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-280 289, Price codes: A05 in paper copy, A01 in microfiche. 1978. 84 p, 2 fig, 9 tab, 100 ref. 68-01-3253.

Descriptors: *Pesticides, *Organic pesticides, *Chlorinated hydrocarbons, *Kepone, *Mirex, *Hexachlorocyclopentadiene, *Environmental effects, Toxicity, Pesticide residues, Chemical wastes, Biochemistry, Animal growth, Marine biology, Aquatic animals, Fish, Human pathology, Soil contamination effects, Water pollution effects, Water pollution sources.

Literature searches conducted by Battelle Columbus Laboratories and the Stanford Research Institute served as a basis for the assessment of the scientific and technical knowledge on the effects of Kepone, mirex and hex as environmental pollutants. Focusing primarily of effects, this study only considers those aspects of transport, transformation, and routes of exposure critical to specific organisms and/or systems. The cyclodiene insecticides Kepone and mirex are synthesized from hexachlorocyclopentadiene (hex). As members of the organochlorine group, Kepone and mirex are generally similar in regard to their chemical characteristics, biological activity, and behavior in the environment. Kepone is environmentally persistent and highly toxic to various organisms. Since it is carcinogenic to laboratory rodents, it is presumed to present a cancer hazard to humans. Mirex has a tendency to bioaccumulate and biomagnify; it degrades into a series of potentially hazardous products including Kepone. It is toxic to human beings, and carcinogenic to laboratory rodents. Hex undergoes bioconcentration and biomagnification in simulated microcosms, thus showing environmental characteristics common to some better known organochlorine compounds. Production is expected to remain at high levels for the manufacture of flame retardants and pesticides for export. The list of research needs identifies where more knowledge is needed to make a truly comprehensive assessment of the effects of these insecticides. (Davison-IPA)
W79-06566

CONTAMINANTS ASSOCIATED WITH DIRECT AND INDIRECT REUSE OF MUNICIPAL WASTEWATER.
SCS Engineers, Long Beach, CA.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-280 482, Price codes: A16 in paper copy, A01 in microfiche. Report No EPA-600/1-78-019, March 1978. 360 p, 4 fig, 113 tab, 716 ref. 68-02-2257.

Descriptors: *Waste water, *Water reuse, *Public health, *Path of pollutants, *Waste water treatment, *Wastes, *Cities, *Waste water disposal, Tertiary treatment, Coagulation, Disinfection, Carbon, Adsorption, Ion exchange, Reverse osmosis, Filtration, Potable water.

A compilation of the available published quantitative data concerning the health effects associated with the reuse of treated municipal waste water is presented. The information includes data on the effectiveness of conventional water and waste water treatment and disposal operations to reduce concentrations of public health contaminants and the transport of these contaminants through the environment to man. The data are organized so that the pollutant paths to man can be evaluated according to public health significance to establish research priorities. Conventional secondary and tertiary waste water treatment processes, and the disposal techniques, direct discharge to fresh surface waters and land application, are evaluated. The water treatment processes evaluated include the conventional treatments, chemical coagulation, with or without filtration, and disinfection, and the advanced water treatments, carbon adsorption, ion exchange and reverse osmosis. Public health considerations are discussed. (Davison-IPA)
W79-06567

THE IMPACT OF BROADLY APPLIED EFFLUENT PHOSPHORUS STANDARDS ON EUTROPHICATION CONTROL,
Corvallis Environmental Research Lab., OR.
J. H. Gakstatter, A. F. Bartsch, and C. A. Callahan.
Water Resources Research, Vol 14, No 6, p 1155-1158, December, 1978. 1 fig, 18 ref.

Descriptors: *Eutrophication, Sewage effluents, Effluents, *Phosphorus, Municipal wastes, Sewage disposal, Model studies, Trophic level.

The potential trophic benefits to lakes and reservoirs of a 1 mg/l and zero-discharge total phosphorus effluent standard for municipal sewage treatment plants were examined by using two phosphorus mass balance models. The analysis included 255 lakes and reservoirs receiving municipal sewage treatment plant effluents and located in the eastern half of the United States. These water bodies, their significant tributaries, and contributing effluents were sampled during the U.S. Environmental Protection Agency's National Eutrophication Survey. Improvement in trophic condition is defined as a predicted decrease of at least 25% in external phosphorus supply, which would cause the predicted in-lake total phosphorus concentration to (1) decrease from greater to less than 40 micrograms/liter but remain above 20 micrograms/liter, (2) decrease from above 20 micrograms/liter to less than 20 micrograms/liter, or (3) decrease from less than 20 micrograms/liter to a lower concentration. Using the definition stated above, the two models indicated that 18-22% of the water bodies would benefit from a 1 mg/l effluent standard. If the requirement were zero phosphorus, 28% of the water bodies would benefit. (Skogerboe-Colorado State)
W79-06642

OCEAN DISPERSAL AS AN ULTIMATE DISPOSAL METHOD,
Philadelphia Water Dept., PA. Water Pollution Control Div.
C. F. Guarino, M. D. Nelson, and S. S. Almeida.
Journal Water Pollution Control Federation, Vol. 51, No. 4, p 773-782, April 1979. 3 fig, 11 tab, 4 ref.

Descriptors: *Waste disposal, *Water pollution effects, *Environmental effects, Sludge disposal, United States, Dispersion, Heavy metals, Bacteria, Polychlorinated biphenyls, *Outer Continental Shelf, *Ocean dumping, *Brazil.

The use of ocean dispersal as an ultimate disposal method for wastewater sludges will end in the United States by 1981. Ocean disposal of sludge has come under attach in the United States from both the professional as well as the layman. Most often, concern is focused on physical changes associated with dumping, such as: degradation of recreational waters, sea bottom build-up, and toxicity to marine life. Yet many researchers have also studied effects that are not quite as obvious: heavy metal concentration in sediments, bacteria in shellfish, and polychlorinated biphenyl (PCB) accumulation. Rio de Janeiro, the major metropolitan area in Brazil, presently discharges almost 65% of its collected wastewater flow directly to the ocean via outfall. Plans are being made, however to treat this flow and of course, dispose of the resulting sludge. In evaluating possible sludge disposal methods, Brazilian engineers have not eliminated ocean disposal. By studying the experience and data developed for the ocean disposal operation used by Philadelphia, Brazilian engineers are evaluating the advantages and disadvantages of ocean use against other possible systems. The results are not yet in but preliminary indications show ocean disposal to be sound sludge management strategy. This report outlines the environmental impact aspects of such an evaluation. The data that have been assembled are largely a result of monitoring efforts carried out at Philadelphia's offshore disposal site by EPA. (Sinha OEIS)
W79-06663

TRANSIENT EFFECTS OF OCEAN WASTEWATER SLUDGE DUMPING,
National Marine Fisheries Service, Highlands, NJ. Sandy Hook Sport Fisheries Marine Lab.
A. F. J. Draxler.
Journal Water Pollution Control Federation, Vol 51, No 4, p 741-748, April 1979. 5 fig, 18 ref.

Descriptors: *Waste water disposal, *Water pollution effects, *Environmental effects, Sludge disposal, New York, Nutrients, Settling velocity, *Outer Continental Shelf, New York Bight, Ocean dumping.

Wastewater sludge from the New York metropolitan area is barged to a site approximately 22-km equidistant between Long Island, New York and Sandy Hook, New Jersey where it is dumped in water 29-m deep. The sludge contains approximately 5% solids, which are 55% organic material, and has a large nutrient and heavy metal content. The spatial and seasonal distribution of nutrients in the water and metals in the sediment of the Bight and the distribution of ammonium nitrogen by waste dumping have both been previously investigated. In contrast to those studies, the purpose of these experiments was to investigate the dynamic processes that follow a single sludge dump: the settling of particulates, the dilution of nutrients, and the changes in oxygen concentration of the receiving water. (Sinha-OEIS)
W79-06664

EFFECTS OF OILFIELD BRINE EFFLUENT ON SEDIMENTS AND BENTHIC ORGANISMS IN TRINITY BAY, TEXAS,
Texas A and M University, College Station. Dept. of Biology.
H. W. Armstrong, K. Fucik, J. W. Anderson, and J. M. Neff.
Marine Environmental Research, Vol. 2, No. 1, p 55-69, January 1979. 3 fig, 2 tab, 34 ref.

Descriptors: *Sediments, *Benthos, *Brines, *Water pollution effects, *Environmental effects, Outfall sewers, Oil pollution, Texas, Resources development, *Outer Continental Shelf, Naphthalenes, Hydrocarbons, Petroleum development, Trinity Bay(TX).

Field studies have established the concentrations of naphthalenes in bay sediments and water in the vicinity of an oil separator platform and their effects on the benthic fauna. Fifteen stations were occupied monthly, from July, 1974 to December, 1975, along three transects extending from the separator platform outfall outwards for a distance of 4.0 to 5.6 km. A lesser number of stations were occupied from April, 1974 to June, 1974. Bottom sediments at each station were analysed for total haphthalenes content and for number of species and individuals. All stations were located in 2 to 3

m of water. The outfall was located 1 m off the bay bottom. There was a definite correlation between sediment naphthalenes concentrations and number of species and individuals. The bay bottom was almost completely devoid of organisms within 15 m of the effluent outfall. Stations located 150 m from the outfall had severely depressed 455 m from the platform were unaffected. Trinity Bay, Texas, the site of this investigation, has a mean depth of 2.5 m. The bay water is highly turbid due to the presence of a high concentration of clay-sized particulate material. The brine outfall was located approximately 1 m above the bay bottom. These special conditions undoubtedly contributed significantly to the observed impact of the brine. Therefore, extrapolations from the results of this study to offshore oil production and brine disposal should be made with extreme caution. (Sinha-OEIS)
W79-06665

EFFECTS OF PRUDHOE BAY CRUDE OIL ON PRIMARY PRODUCTION AND ZOOPLANKTON IN ARCTIC TRUNDRA THAW PONDS,
Cincinnati Univ., OH. Dept. of Biological Sciences.
T. W. Federle, J. R. Vestal, G. R. Hater, and M. C. Miller.
Marine Environmental Research, Vol. 2, No. 1, p 3-18, January 1979. 8 fig, 2 tab, 17 ref.

Descriptors: *Oil pollution, *Zooplankton, *Phytoplankton, *Primary productivity, *Water pollution effects, Alaska, Tundra, Environmental effect, Resources development, *Outer Continental Shelf, Prudhoe Bay(AK), Petroleum development, Oil transport.

The effects of Prudhoe Bay, Alaska, Crude oil on the indigenous phytoplankton and zooplankton of tundra thaw ponds were studied under controlled conditions in sity during the summer of 1976. These effects were compared with uncontrolled oil spills on Pond Omega (a year previously) and Pond E (six years previously). In the uncontrolled spills, the phytoplankton species composition of both ponds remained appreciably different compared with control Pond C, although phytoplankton biomass did not differ greatly. Primary production remained low in Pond Omega but had recovered to control levels in Pond E. In controlled subpond experiments, oil caused a decrease of about 90-100% in primary production in five days but recovered to 40-50% of the control level within fifteen days. During that time, phytoplankton biomass decreased initially but recovered within fifteen days. Oil caused a shift in phytoplankton species composition from a predominance of cryptophytes to chrysophytes. Subponds containing two Daphnia middendorffiana and one Brachinecta paludosa per litre of pondwater were also affected by oil, causing zooplankton death within three or four days. After tht time, changes in the phytoplankton species composition were similar to control subponds without zooplankton. Oil toxicity to zooplankton or experimental removal resulted in a loss of grazing pressure which caused the elimination of the cryptophyte Rhodomonas sp. This species was still absent from Pond Omega, but was seen in Pond E for the first time, when zooplankton also re appeared after six years. Oil perturbation of tundra thaw ponds causes a loss of zooplankton and a reduction in primary production. Phytoplankton primary production recovers somewhat but algal species composition remains changed because of the loss of zooplankton grazing pressure and the selective effects of oil. (Sinha-OEIS)
W79-06666

OIL, FISHERIES, AND THE HEALTH OF THE ECOSYSTEM: A REVIEW,
National Marine Fisheries Service, Woods Hole, MA. Northeast Fisheries Center.
K. Sherman, and J. B. Pearce.
In: Marine Studies of San Pedro Bay, California. Part 15, p 240-258, December 1978. 3 tab, 33 ref.

Descriptors: *Oil pollution, *Water pollution effects, *Oil spills, *Environmental effects, Fisheries, Ecosystems, Resources development, *Outer Continental Shelf, Petroleum hydrocarbons.

An overview of the effects of petroleum hydrocarbons in the marine environment on fisheries and on ecosystems is presented. Assessments of damage from major spills are reviewed. Each year 6 million metric tons of petroleum hydrocarbons enter the ocean. Of this amount 1% is attributable to offshore production, 44% is introduced from municipal and industrial wastes and river and urban runoff, 35% from transport and offloading operations, and 20% from natural seeps and atmospheric fallout. Measured against this total, an acute tanker spill represents a relatively small percentage of annual input. The Argo Merchant spill, while spectacular, represented 1% of the total annual input of oil in the marine environment. Oil is a complex mixture of hydrocarbons. Its toxicity to marine organisms is roughly proportional to its aromatic content. Greatest damage from a spill of petroleum hydrocarbons in a shallow nearshore environment results from the mixing of petroleum hydrocarbons in the water column, and subsequent penetration in the sediments. This action increases the residence time of the oil. (Sinha-OEIS)
W79-06667

FINAL REPORT ON THE BASELINE ENVIRONMENTAL SURVEY OF THE MAFLA LEASE AREAS.
State Univ. System of Florida Inst. of Oceanography, St. Petersburg.
For primary bibliographic entry see Field 5B.
W79-06668

GROUND-WATER CONTAMINATION BY FERTILIZER NITROGEN,
Science and Education Administration, Fort Collins, CO.
H. R. Duke, D. E. Smika, and D. F. Heermann.
Journal of the Irrigation and Drainage Division, Proceedings of the American Society of Civil Engineers, Vol. 104, No. IR3, p 283-291, September 1978. 6 fig, 2 tab, 8 ref.

Descriptors: *Irrigation, *Groundwater, *Water quality, *Sprinklers, Aquifers, Nitrogen, Agriculture, Percolation, Water table, Water samples, Deep soil cores.

Nitrogen percolation beneath the crop root zone was significantly reduced by careful irrigation management using the USDA irrigation scheduling program. Deep percolation losses were measured directly using vacuum extractors. Analyses of both deep soil cores and water samples from piezometers suggest that significant amounts of percolating nitrate are removed by denitrification, either before or soon after reaching the water table, thus reducing the potential for groundwater contamination. (Bell-Graf--Cornell)
W79-06672

SURFICIAL SEDIMENTS,
National Oceanic and Atmospheric Administration, Miami, FL. Atlantic Oceanographic and Meteorological Labs.
For primary bibliographic entry see Field 5B.
W79-06690

MONITORING PROGRAM NEEDED FOR WISE TREATMENT CHOICES,
Beak Consultants Ltd., Vancouver (British Columbia).
For primary bibliographic entry see Field 5A.
W79-06722

VARIATION IN THE CHEMICAL COMPOSITION OF FRESHWATER FISH,
Auburn Univ., AL. Dept. of Fisheries and Allied Aquacultures.
J. A. Davis.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-295 810, Price codes: A04 in paper copy, A01 in microfiche. Ph.D. Dissertation, Aquacultures, 1978, 58 p, 2 fig, 13 tab, 38 ref. OWRT A-066-ALA (1), 14-34-0001-8001.

Descriptors: Chemical composition, *Freshwater fish, Calcium, Magnesium, Sodium manganese, Phosphorus, Zinc, Copper, Ash, Oxygen, Lepomis macrochirus.

Three possible sources of variation in the chemical composition of freshwater fish were explored. These were (1) intersite variation of elements in fish and its relationship to the concentrations of the elements in the water from which they were taken, (2) intraspecific variation with respect to size of the fish, and (3) interspecific variation of chemical composition among species. Fish were collected from lentic waters representing widely varying water qualities to determine if concentrations of elements in water significantly affect their chemical composition. Statistical analyses indicated no significant relationships existed between Ca, Mg, Na, K, N, S, P, Zn and Cu concentrations in fish and the waters from which they were taken. This low correlation is probably due to homeostatic control of these elements by fish. Analyses of two size series of Lepomis macrochirus indicated positive correlations with length and concentrations of Ca, Na, P, Mn and ash. Negative correlations were shown for total-N, K, S and Zn concentrations and length. Eighteen species of freshwater fish were analyzed to determine variation among fish species. Ca, Mg, Na, Mn, P, Zn, Cu, ash and oxygen consumed demonstrated the greatest variation among species. Generally greatest variation was found among species and least variation was found among sizes.
W79-06732

ATTITUDES OF NEARBY RESIDENTS TOWARD ESTABLISHING SANITARY LANDFILLS,
Economics, Statistics, and Cooperative Services, Washington, DC.
D. T. Massey.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-278 905, Price codes: A04 in paper copy, A01 in microfiche. Final Report No ESCS-03, 1974. 65 p, 33 tab, 4 append.

Descriptors: *Landfills, *Attitudes, *Land use, *Wastes, *Water pollution, *Water pollution sources, Waste disposal, Waste treatment, Environmental engineering, Environmental sanitation, Air pollution, Land development, Land reclamation, Effluents, Social values.

The attitudes of citizens in four survey areas concerning proposed or newly established landfills are analyzed in relation to factors that may influence those attitudes, and the major factors influencing the decision to oppose or favor a landfill's establishment are identified. Resident opposition to the establishment of sanitary landfills in nearby areas is largely due to the possibilities of water pollution, insects and rodents, odors, and blowing papers from the site. It is felt that these factors would be detrimental to property values. Public support of landfills was also discouraged by the use of land better suited for agriculture and heavy truck traffic on local roads. Most residents surveyed felt that landfills should be located at least 1 mile from residences and that landfills should be in operation less than 5 years. Promises concerning improved collection and disposal service, free access to the site, and development of the site as a future park or recreation area had little influence on those opposing or favoring the landfill. (Davison-IPA)
W79-06785

EVALUATION OF HYDROLOGIC MODELING TECHNIQUES FOR FOREST LAND MANAGEMENT PLANNING,
Washington State Dept. of Natural Resources, Olympia.
For primary bibliographic entry see Field 2E.
W79-06801

ENERGY ANALYSIS OF REGIONAL WATER POLLUTION CONTROL,
Oregon State Univ., Corvallis.
R. J. Heggen, and K. J. Williamson.
Journal of the Water Pollution Control Federation, Vol. 51, No. 4, p 759-772, April 1979. 10 fig, 7 tab, 7 equ, 8 ref.

Descriptors: *Water pollution control, *Input-output analysis, *Methodology, *Energy, *Alternative planning, *Costs, Regional development, Effects, Dissolved oxygen, Rivers, Environmental control, Runoff, Flow augmentation, Cost allocation, Waste water treatment, Multiple-purpose reservoirs, Benefits, Evaluation, Mathematical models, Systems analysis, Equations, Willamette River(Oregon).

Two strategic approaches to water quality control in Oregon's Willamette River are presently being utilized: point source treatment and flow augmentation from reservoirs. Input-output analysis provides an econometric methodology to study direct and indirect response to pollution control alternatives. An energy input-output national model is coupled with a comprehensive Willamette River dissolved oxygen model. Alternatives of environmental control are evaluated as if they had been practiced in a study year of low natural runoff. The relation of augmentation for water quality to other river uses is used to value flow in a benefits-foregone manner. Independently, reservoir costs are allocated to water quality. For alternatives of treatment and augmentation, river quality, dollar cost and energy impact response surfaces are developed. Energy and dollar-efficient management call for the full role of augmentation in water quality control. (Bell Graf-Cornell)
W79-06802

OPERATORS PRESENT TESTIMONY IN DEFENSE OF PLAYA LAKE DISPOSAL,
J. Brewster.
Drill Bit, Vol. 28, No. 4, p 26-27, April, 1979.

Descriptors: *Playas, *Brine disposal, *Environmental effects, Waterfowl, Wading birds, Water pollution, Groundwater, Water pollution sources.

Key points underlying the controversy concerning environmental effects of brine disposal in playa lakes of west Texas are discussed. Disposal is confined to five lakes with a total area of over 7,000 acres. The number of bird kills due to oil and salt is disputable. The salinity of the lakes is higher than the brines due to rates of inflow and evaporation. The charge that brine disposal may contaminate ground water is unfounded since the aquifers in West Texas are situated above the playa lakes. Contamination would result only from heavy rains that would raise the level of the lake and reverse the flow of groundwater into the aquifer. (Purdin-NWWA)
W79-06808

BIOLOGICAL AND MICROBIOLOGICAL ASSESSMENT OF THE UPPER CHATTAHOOCHEE RIVER BASIN, GEORGIA,
Geological Survey, Doraville, GA. Water Resources Div.
B. W. Lium, J. K. Stamer, T. A. Ehlke, R. E. Faye, and R. N. Cherry.
Available from Branch of Distribution, USGS 1200 S. Eads St. Arlington, VA 22202. Geological Survey Circular 796, 1979. 22 p, 22 fig, 5 tab, 16 ref.

Descriptors: *Algae, *Phytoplankton, *Nutrients, *Rivers, *Lakes, Eutrophication, Streamflow, Effluents, Waste water disposal, Dissolved oxygen, Low flow, Nitrification, Diatoms, Microorganisms, Georgia, *Upper Chattahoochee River basin, *West Point Lake(Ga).

Biological and microbiological studies were conducted by the U.S. Geological Survey as a part of the Intensive River-Quality Assessment studies of the upper Chattahoochee River basin, Georgia. Phytoplankton concentrations in cells per milliliter (cells/mL) were generally higher downstream from Atlanta than upstream. The highest concentrations, mostly blue-green algae, occurred in West Point Lake with an average of 90,000 cells/mL for the sampling period. The lowest concentrations, 1,000 cells/mL, occurred upstream of Lake Sidney Lanier. Dissolved orthophosphate and nitrite plus nitrate concentrations were highest in the river reaches and upper reaches of the two lakes and were lowest at the dam pools of both lakes. The high nitrite plus nitrate concentrations downstream from Atlanta were primarily a result of nitrification by Nitrosomonas and Nitrobacter bacteria. Algal growth potential was highest downstream from Atlanta, 25 milligrams per liter (mg/L) at Whitesburg, and was the lowest in the headwaters and at the dam pools of Lake Sidney Lanier and West Point Lake. The rate of nitrification in the Atlanta to Franklin reach of the river was comparatively low, 0.02 mg/L per hour. Nitrification was an important cause of dissolved-oxygen consumption in a 45-mi reach of the river downstream from the Atlanta wastewater treatment facilities. Dissolved-oxygen consumption as a result of nitrification may be greatest during low flow. (Woodard-USGS)
W79-06819

IMPACT OF COPPER MINING ON A DESERT INTERMITTENT STREAM IN CENTRAL ARIZONA: A SUMMARY,
Arizona State Univ., Tempe. Dept. of Zoology.
M. A. Lewis, and R. Burraychak.
Journal of the Arizona-Nevada Academy of Science, Vol. 14, No. 1, p 22-29, Feb. 1979, 3 fig, 2 tab, 33 ref.

Descriptors: *Mine water, *Mine wastes, *Environmental effects, *Aquatic habitats, *Pollutant identification, Sedimentation, Primary productivity, Mining, Water quality, Ephemeral streams, Water chemistry, Aquatic environments, Fish populations, Suspended solids, Hydrobiology, Microbial degradation, Biota, Water pollution, Heavy metals, Arizona, Diel migration.

The present report summarizes the results of a 2 year study conducted at the Pinto Valley Mine at Pinto Creek in the Tonto National Forest, Gila County, Arizona, to determine the detrimental impact of a large mine on biotic survival in a small desert stream. Water chemistry of Pinto Creek was monitored bi-weekly during 1975-1976 at 4 stations, one above and three below the discharge points, by Tonto National Forest service personnel following standard procedure. Primary production for 2 stream areas was estimated from analysis of diel changes in dissolved oxygen. Surveys of fish, aquatic macroinvertebrates, and vegetation were conducted during 1975-1976 at 13 sampling stations along the total length of the stream. Results clearly indicated the hazards of mining to the stream biota with sedimentation having the primary detrimental effect by elimination of much of the biota, reduction of primary production, and alteration of normal habitat. Unlike suspended solids, however, heavy metals entering the stream were found to be sufficiently diluted to non-toxic levels. Although the quantity and quality of the biota were not as yet noticeably affected 10 km downstream from the discharge channels, sediment encroachment is expected to cause a reduction in primary production both as a direct source of food and as a primary source of energy. (Tickes-Arizona)
W79-06840

FISH TOXICITY EVALUATION OF EFFLUENTS FROM AN ORGANIC CHEMICAL PRODUCTION COMPLEX, BASF, GERMANY,
Department of Fisheries and Environment, Ottawa (Ontario). Wastewater Technology Centre.
V. W. Cairns, K. Conn, B. E. Jank, and U. Pagga.
Technology Development Report EPS 4-WP-79-3, February 1979, 58 p, 10 fig, 9 tab, 4 app.

Descriptors: *Fish, *Toxicity, *Effluents, *Organic wastes, *Chemical wastes, Waste water treatment, Chemical analysis, Pollutants, Temperature.

BASF Aktiengesellschaft of the Federal Republic of Germany and the Environmental Protection Service, Canada cooperated in a study to assess the toxicity reduction capability of the wastewater treatment system for the BASF plant at Ludwigshafen, Federal Republic of West Germany. Information obtained was to be used for assessment of best practicable technology for the Canadian organic chemical industry as part of Environment Canada's program of developing regulations and guidelines governing discharge of pollutants. A preliminary program, Phase 1, carried out by BASF, determined that no change in acute toxicity or chemical composition occurred in wastewaters subjected to 48-hour, non-refrigerated storage. For Phase 2 of the operation, eight-hour composite samples of raw wastewater, primary settled effluent and activated sludge plant effluent were collected by BASF personnel and shipped by air to the Wastewater Technology Centre, Burlington, Ontario for toxicity testing. A total of 18 samples were shipped over a period of four weeks. Bioassays and chemical analyses were carried out on the samples both as received and after removal of ammonia using clinoptilolite. All samples exhibited lethality to rainbow trout and although ammonia removal was not complete in all cases, results suggested that a significant portion of the toxicity in the samples could not be attributed to ammonia. After comparing analytical data with long term performance data, it was concluded that bioassay results are representative of what could be expected during long term operation of the treatment system. (WATDOC)
W79-06848

EFFECT OF UPGRADING A MUNICIPAL WASTEWATER EFFLUENT ON POLLUTION INDICATOR AND OTHER MICROORGANISMS IN RIVER WATER,
Connecticut Univ., Noank. Marine Research Lab.
For primary bibliographic entry see Field 5B.
W79-06856

FURTHER STUDIES ON THE EFFECTS OF STRESS IN THE ADULT ON THE EGGS OF MYTILUS EDULIS,
Institute for Marine Environmental Research, Plymouth (England).
B. L. Bayne, D. L. Holland, M. N. Moore, D. M. Lowe, and J. Widdows.
Journal of the Marine Biological Association of the United Kingdom, Vol. 58, No. 4, p 825-841, 1978, 3 fig, 10 tab, 2 plates, 26 ref.

Descriptors: *Environmental effects, *Stress, Thermal stress, Temperature, Salinity, Food abundance, Mussels, Reproduction, Animal physiology.

Groups of mussels were exposed to varying temperature, salinity and food conditions. Measurements of the energy status of individuals was used to assess the physiological condition of adults. As a result of stress to adults, resorption of some ripe gametes occurred as well as lysosomal destabilization in the both the digestive cells and the Leydig cells. Mussels under stress produced fewer and smaller eggs, in smaller follicles, than those not under stress. Eggs from stressed females contained less lipid and protein than eggs from unstressed females. The importance of these physiological relationships in understanding environmental impact on ecological fitness is pointed out. (Chilton-ORNL)
W79-06857

BIOLOGICAL TREATMENT, EFFLUENT REUSE, AND SLUDGE HANDLING FOR THE SIDE LEATHER TANNING INDUSTRY,
Polkowski, Boyle and Associates, Madison, WI.
For primary bibliographic entry see Field 5D.
W79-06865

THIRD ANNOTATED BIBLIOGRAPHY ON BIOLOGICAL EFFECTS OF METALS IN AQUATIC ENVIRONMENTS (NO. 1293-2246),
Environmental Research Lab., Narragansett, RI.
R. Eisler, D. J. O'Neill, Jr., and G. W. Thompson.

Available from the National Technical Information Service, Springfield, VA 22161 as PB-280 953, Price codes: A21 in paper copy, A01 in microfiche. Report No. EPA-600/3-78-005, January 1978. 493 p.

Descriptors: *Bibliographies, *Publications, *Environmental effects, *Aquatic environment, *Metals, Toxicity, Behavior, Animal growth, Plant growth, Reproduction, Retention, Salt balance, Documentation.

A total of 954 journal articles and laboratory and field investigation reports are listed on toxicological, physiological and metabolic effects of stable and radioactive species of heavy metals and other cations to aquatic life. Each reference is annotated and indexed by metal, by taxon and by author. Most references listed were published between 1971 and 1976, but a large minority, in print for sometime, have only recently become available. The selected articles emphasize the following response parameters: survival; growth; reproduction; behavior; bioaccumulation; retention; translocation; histopathology; baseline data on elemental composition; changes in exogenous salt content on responses including internal changes in salt balance of body fluids and tissues; interaction effects of metals and their salts in combination with other substances; and modifying effects of biotic and abiotic factors on all parameters examined. Three cumulative indices encompassing this volume and two preceding volumes are presented: Index-Metals, Index-Taxa, and Index-Authors. (Davison-IPA)
W79-06866

TEMPERATURE EFFECTS ON THE INCORPORATION OF SIALIC ACID INTO GANGLIOSIDES AND GLYCOPROTEINS OF FISH BRAIN,
Stuttgart Univ. (Germany, F.R.). Zoologisches Inst.
H. Rosner, H. Breer, R. Hilbig, and H. Rahmann.
Journal of Thermal Biology, Vol. 4, p 69-73, 1979, 2 fig, 1 tab, 27 ref.

Descriptors: *Environmental effects, *Temperature, Fish, Physiology, Seasonal, Central nervous system.

The influence of temperature changes on the incorporation of sialic acid into brain gangliosides and sialoglycoproteins in fish was investigated following intracranial injections of the specific precursor N-(H3) acetylmannosamine. The data show that radioactive in vivo labelling of brain gangliosides and sialoglycoproteins by application of N-(H3) acetylmannosamine is much more temperature-sensitive than the radioactive labelling of brain proteins by means of (H3) leucine. Brain gangliosides were labelled 4-5 times more heavily at 20 C as compared to 7 C, whereas sialoglycoproteins are labelled only 2-3 times as much. Renewal of gangliosides in the nerve endings of the optic tract was negligible at 7 C. It was concluded that at lower environmental temperatures the turnover of multisialogangliosides is diminished to a larger extent than that of oligosialogangliosides. These differentiated temperature effects may be the reason for seasonal changes in the brain ganglioside pattern observed in goldfish, carp and rainbow trout. (Chilton-ORNL)
W79-06875

COUNTY DRAINAGE DITCHES IN SOUTH CENTRAL MINNESOTA: A UNIQUE RIPARIAN ECOSYSTEM,
Mankato State Univ., MN. Dept. of Biology.
For primary bibliographic entry see Field 4A.
W79-06876

PROCEEDINGS: LAKE MANAGEMENT CONFERENCE, JUNE 9, 1977, UNIVERSITY OF CONNECTICUT, STORRS.
Connecticut Univ., Storrs. Inst. of Water Resources.
For primary bibliographic entry see Field 2H.
W79-06893

THE HEALTH EFFECTS OF GROUND WATER RECHARGE. PART I,
National Water Well Association, Worthington, OH.
T. E. Gass.
Water Well Journal, Vol. 33, No. 4, p 34-35, April, 1979.

Descriptors: *Artificial recharge, *Waste water pollution, *Water reuse, Groundwater, Water quality, Pollutants, Bacteria, Viruses, Inorganic compounds, Organic compounds, Trace elements, Toxicity, Recycling.

The potential health effects resulting from the use of surplus wastewater for artificial ground water recharge are discussed. The quality and chemical composition of such wastewater and excess surface runoff must be carefully examined and controlled to avoid long-term contamination of aquifers. Contaminating agents are either biological or chemical. Giardiasis is a common bacteria found in contaminated drinking water which causes an intestinal disease. Viruses, such as hepatitis are extremely difficult to monitor but have been clearly traced to sewage-contaminated water. Arsenic and Barium are two potentially toxic inorganic compounds found in water. Unlike inorganic chemicals, the presence of even trace amounts of organic chemicals in treated, reclaimed water is of great concern. The long-term effects of low doses of potentially toxic compound in water is not known. (See also W79-06896) (Purdin-NWWA)
W79-06895

WATERBORNE DISEASE - A STATUS REPORT EMPHASIZING OUTBREAKS IN GROUND WATER SYSTEMS,
Health Effects Research Lab., Cincinnati, OH.
For primary bibliographic entry see Field 5B.
W79-06909

WATERBORNE DISEASE - CURRENT THREAT,
California Univ., Berkeley. School of Public Health.
R. C. Cooper.
Ground Water, Vol. 17, No. 2, p 192-196, March-April, 1979. 2 tab, 24 ref.

Descriptors: *Water quality, *Diseases, *Water treatment, Organic compounds, Trace elements, Hardness(Water), Asbestos, Water sources, Potable water, Groundwater.

Modern water treatment technology can reduce the number of known pathogens to acceptable levels. Certainty of such control depends upon treatment plant reliability and integrity of water distribution lines. Water supplies that meet bacterial standards may still transmit viruses. Soft water has been associated with a higher incidence of cardiovascular disease, infant mortality, and spina bifida. Asbestos has been suspected as a possible contributor to the incidence of cancer. The public health implications of the presence of trace amounts of organic compounds in water is uncertain due to the chronic nature of diseases suspected to be associated with these chemicals and the uncertainty involved in extrapolating data from test animal receiving high doses of suspect compounds. Epidemiological evidence is accumulating that indicates correlations between trihalomethanes (including chloroform) in drinking water and cancer morbidity (mortality). Recently the U.S.E.P.A. has put forth a target level of 100 mg/l for THM in drinking water. Correlations between water source and cancer have also been shown. Cancer rates are frequently higher in areas that obtain drinking water from surface streams than in areas that use ground water. (Purdin-NWWA)
W79-06910

WATERBORNE DISEASE - HISTORICAL LESSON,
Illinois Environmental Protection Agency, Springfield. Div. of Public Water Supplies.
I. M. Markwood.
Ground Water, Vol. 17, No. 2, p 197-198, March-April, 1979.

Descriptors: *Waterborne diseases, *Water supply, Disinfection, Water treatment, Microorganisms.

With modern technology and proper precaution epidemics of typhoid, cholera and other waterborne diseases are no longer a threat. All waterborne outbreaks in public water supplies in this country since World War II have been caused by breakdowns in disinfection procedures or carelessness. If the lessons of history were followed exactly, water borne disease transmission by public water systems would no longer occur. (Purdin-NWWA)
W79-06911

ECOLOGICAL EFFECTS OF URBAN STORMWATER RUNOFF ON BENTHIC MACROINVERTEBRATES INHABITING THE GREEN RIVER, MASSACHUSETTS,
Massachusetts Univ., Waltham. Dept. of Environmental Sciences.
J. M. Pratt, and R. A. Coler.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-296 315, Price codes: A05 in paper copy, A01 in microfiche. University of Massachusetts Water Resources Research Center Publication No. 100, 1979. 75 p, 6 fig, 14 tab, 46 ref. OWRT-A-094-MASS (1), 14-34-0001-7046.

Descriptors: Aquatic animals, *Aquatic insects, *Bioindicators, *Environmental effects, Biological communities, Impaired water quality, Invertebrates, Massachusetts, Rivers, Runoff, *Urban runoff, *Water pollution effects, Indicator organisms, Green River.

Although it has been demonstrated that urban stormwater runoff can alter the quality of receiving waters, the corresponding impact on aquatic biota remains essentially undocumented. A year-long intensive study, therefore, was implemented to monitor and describe ecological effects exerted by urban runoff on benthic macroinvertebrates, and to develop practical methodologies for biological monitoring. Rock-filled, basket-type artificial substrates deployed periodically in nonurban and urban river reaches yielded collections of macroinvertebrates that furnished data for: (1) species diversity (the Brillouin index, H), (2) hierarchical diversity, (3) major-taxa composition, (4) collection dissimiliarity at the species level, and (5) indicator species. The overall results from these five analytical procedures strongly indicate that the macrobenthic community became progressively disrupted downstream in the urban reach. The stress imposed by urban runoff was most acute during the summer low flow and was probably localized in or near the stream bed. To assess the impact of urban runoff on an aquatic ecosystem, physical, chemical, and biological monitoring, therefore, should extend routinely into the benthos. (Godfrey-Mass)
W79-06917

HEALTH EFFECTS OF HUMAN EXPOSURE TO BARIUM IN DRINKING WATER,
Illinois Univ. at the Medical Center, Chicago.
G. R. Brenniman, W. H. Kojola, P. S. Levy, B. W. Carnow, and T. Namekata.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-292 268, Price codes: A07 in paper copy, A01 in microfiche. Final Report No. EPA-600/1-79-003, January 1979. 140 p, 4 fig, 81 tab, 71 ref, 4 append. R803918.

Descriptors: *Potable water, *Barium, *Public health, *Human pathology, Water pollution effects, Toxicity, Water analysis, Human diseases, Mortality, Morbidity, Epidemiology, West Dundee, McHenry(Illinois).

An investigation was undertaken to determine if health effects could be identified in a population exposed to barium in its drinking water. An analysis of death rates for communities exposed to barium concentrations of 2 mg/l or greater and

those with no significant exposure showed higher death rates for all 'cardiovascular diseases' and 'heart diseases' in barium exposed communities. A morbidity study was conducted in West Dundee and Mc Henry, Illinois, to determine if differences exist in mean blood pressure levels and the presence of hypertension, cardiovascular, cerebro-vascular and renal disease between the two populations. West Dundee's drinking water had a barium concentration 70 times that of the Mc Henry drinking water. Some significant differences were found for mean age and sex-adjusted levels of systolic blood pressures between the two communities, but these data were inconclusive due to inconsistencies in the findings. No significant differences were found between the communities regarding the prevalence of hypertension, heart disease, stroke, or kidney disease. No definite conclusion was drawn to permit the recommendation of a safe standard for barium in drinking water. (Davison-IPA)
W79-06944

HUMAN HEALTH EFFECTS OF MOLYBDENUM IN DRINKING WATER,
Colorado Univ., Boulder. Environmental Trace Substances Research Program.
W. R. Chappell, R. R. Meglen, R. Moure-Eraso, C. C. Solomons, and T. A. Tsongas.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-292 755, Price codes: A06 in paper copy, A01 in microfiche. Final Report No. EPA-600/1-79-006, January 1979. 113 p, 19 fig, 23 tab, 187 ref, 3 append. R-803645.

Descriptors: *Potable water, *Molybdenum, *Public health, *Human pathology, Water analysis, Chemical analysis, Biochemistry, Animal physiology, Metabolism, Nutrient requirements, Waste water treatment, Water treatment, Water quality standards.

An assessment of the present environmental exposure to molybdenum and the health effects of such an exposure are presented. Molybdenum (MO), a trace element widely occurring in nature, plays an important biological role as a micronutrient for plants and animals. It can be toxic to animals at high levels. Concentration in surface waters is generally less than 5 micrograms/L, concentrations as high as 500 micrograms/L has been reported in some drinking waters. Greater concentrations than 20 micrograms/L are thought to be the result of industrial contamination. Conventional waste water and water treatment technoligies remove only 14% of molybdenum. In the U.S. average human intake via food is 170 micorgrams Mo/day; the average intake via drinking water is less than 5 micrograms Mo/day. No adverse health effects have been reported in the U.S., but Russian and Indian literature report cases of biochemical and clinical effects in humans at intakes ranging from 1 to 10 mg Mo/day. Data on molybdenum relating to the effects of its occurrence in drinking water are reviewed. An interdisciplinary study is also reviewed. Although a drinking water standard for molybdenum is not required, a maximum of 50 micrograms Mo/L is recommended as a guideline. (Davison-IPA)
W79-06945

EFFECTS OF DIVERSION AND ALUM APPLICATION ON TWO EUTROPHIC LAKES,
Kent State Univ., OH. Dept. of Biological Sciences.
For primary bibliographic entry see Field 5D.
W79-06950

SOME BIOCHEMICAL AND PHYSIOLOGICAL ASPECTS OF GROWTH AND GAMETOGENESIS IN CRASSOSTREA GIGAS AND OSTREA EDULIS GROWN AT SUSTAINED ELEVATED TEMPERATURES,
Woods Hole Oceanographic Institution, MA.
R. Mann.
Journal of the Marine Biological Association of the United Kingdom, Vol. 59, No. 1, p 95-110, 1979, 5 fig, 2 tab, 38 ref.

Descriptors: *Environmental effects, Temperature, Oysters, Reproduction, Spawning, Biochemistry, Animal physiology, Growth rates.

Two species of oysters (Crassotrea gigas and Ostrea edulis) were grown at sustained temperatures of 12, 15, 18, and 21 C for 19 weeks. Absolute live weight increment over the experimental period was greater in C. gigas than in O. edulis. Terminal live weights increased with increasing temperature in both species. Final dry meat weight was not related to temperature in C. gigas but was positively related to increasing experimental temperature in O. edulis. Both species showed an initial increase in percentage carbohydrate at all temperatures which was followed by a decrease in carbohydrate content in C. gigas. Evidence of hermaphroditism was found in 27% of O. edulis examined while none was found in C. gigas. Ripe gonads developed in both species at all temperatures but C. gigas spawned only at 18 and 21 C while O. edulis spawned at 15, 18, and 21 C. In the pre-spawning period, ammonia excretion data showed an allometric relationship with weight in both species. Post-spawning data showed a higher specific excretion rate for any given dry meat weight. Post-spawning data points do not fit any simple relationship that can be described by linear regression analysis. (Chilton-ORNL)
W79-06958

BRAIN GANGLIOSIDES AND TEMPERATURE ADAPTATION IN EURY- AND STENOTHERMIC TELEOST FISH (CARP AND RAINBOW TROUT),
Stuttgart Univ. (Germany, F.R.). Zoologisches Inst.
R. Hilbig, H. Rahmann, and H. Rosner.
Journal of Thermal Biology, Vol. 4, p 29-34, 1979, 6 fig, 32 ref.

Descriptors: *Environmental effects, *Temperature, Seasonal, Fish, Carp, Rainbow trout, Physiology, Temperature adaptation, Acclimation, Fish brain, Nervous system.

Data showed significant changes in the brain ganglioside pattern of carp and rainbow trout during thermal adaptation to lowered environmental temperatures. During adaptation to experimentally induced acclimation as well as to seasonal temperature fluctuations, distinct changes in the brain gangliosides to a more polar pattern could be detected. In carp, this polysialization phenomenon was due to a decrease of almost all oligosialogangliosides in favor of polar fractions. In trout brains a more differentiated pattern change occurred, which was characterized by a conspicuous decrease in the concentration of the hematosideganglioside. Further investigation into these physico-chemical properties of brain gangliosides and ganglioside-containing membrane preparations of animals from different temperature biotopes is needed. (Chilton-ORNL)
W79-06983

EFFECT OF HAZARDOUS MATERIAL SPILLS ON BIOLOGICAL TREATMENT PROCESSES,
Environmental Quality Systems, Inc., Rockville, MD.
For primary bibliographic entry see Field 7B.
W79-07000

5D. Waste Treatment Processes

CHEMICAL TECHNOLOGY AND ECONOMICS IN ENVIRONMENTAL PERSPECTIVES; TASK IV - ACTIVATED CARBON,
Midwest Research Inst., Kansas City, MO.
G. L. Kelso, and T. W. Lapp.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-266 181, Price codes: A03 in paper copy, A01 in microfiche. Report EPA-560/2-77-002. 1977. 28 p, 5 tab, 21 ref.

Descriptors: *Activated carbon, *Specifications, *Standards, Heavy metals, Food processing industry, Waste water treatment, Water treatment, Organic compounds, Economics.

Information on various aspects of the manufacture and use of activated carbon was compiled. Market input-output data was determined including manufacturers, manufacturing sites, raw materials, production volumes, grades of product, and use patterns. Product quality specifications were determined with respect to the presence of heavy metal ions and/or polynuclear aromatic hydrocarbons in the commercial product. If impurities were present, procedures for their removal were determined. US annual capacity is 305 million lb of which about one half is granular. Of the 180 lb consumed in the US in 1975, 37% was used in the food processing and pharmaceutical industries, 25% in water or waste treatment processes, and 38% in other applications. The Food Chemicals Codex and specific consumer specifications are employed for heavy metal and polynuclear hydrocarbon content. Due to temperatures of about 1000C reached during the steam activation process, little, if any, quantities of PAH remain in activated carbon. (Small-FIRL)
W79-06507

WATER HYACINTHS FOR UPGRADING SEWAGE LAGOONS TO MEET ADVANCED WASTEWATER TREATMENT STANDARDS: PART II,
National Space Technology Labs., NSTL Station, MS.
B. C. Wolverton, and R. C. McDonald.
Available from the National Technical Information Service, Springfield, VA 22161 as N78-16481, Price codes: A02 in paper copy, A01 in microfiche. Report TM-X-72730, 1976. 22 p, 10 fig, 2 tab, 8 ref.

Descriptors: *Waste water treatment, *Water hyacinth, *Sewage lagoons, Filtration, Standards, *Efficiency, Waterfowl, Biological oxygen demand, Suspended solids.

Field studies on the use of water hyacinths (Eichhornia crassipes) as an inexpensive, natural biological waste filtration system for upgrading sewage lagoons, are reviewed. A single cell lagoon containing four or five surface hectares covered with water hyacinths with a retention time of at least 12 days, met the sewage effluent standards of Bay St. Louis. Over a four month period, the BOD dropped from 22 mg/liter to an average of 16 mg/liter and total suspended solids were reduced by 88% in the effluent from a background level of 125 mg/liter to 15 mg/liter. Water hyacinths were also a successful sewage treatment process for the Orange Grove lagoon. Coots were found to feed on the water hyacinths and could greatly decrease the efficiency of the system. Thus, it is necessary to protect the hyacinths from birds. (See also W77-00621) (Small-FIRL)
W79-06508

DISINFECTION EFFICIENCY AND RESIDUAL TOXICITY OF SEVERAL WASTEWATER DISINFECTANTS. VOLUME II. WYOMING, MICHIGAN,
Grand Valley State Colleges, Allendale, MI.
R. W. Ward, R. D. Giffin, and G. M. DeGraeve.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-274 448, Price codes: A06 in paper copy, A01 in microfiche. Report EPA-600/2-77-203, 1977. 105 p, 21 fig, 38 tab, 33 ref.

Descriptors: *Waste water treatment, *Toxicity, *Chlorine, *Ozone, *Performance, Bromine, Municipal wastes, Disinfection, Fish, Minnows, Bioassay.

The effectiveness of chlorine, bromine chloride, and ozone as waste water disinfectants was compared, and the residual toxicity associated with disinfection by these methods or with chlorinated waste water which was dechlorinated with sulfur dioxide, was investigated. Nondisinfected trickling filter effluent from the Wyoming, Michigan Wastewater Treatment Plan was used in the tests. Three streams of the effluent were disinfected with

either chlorine, bromine chloride, or ozone and then delivered to the bioassay laboratory for residual toxicity tests. A fourth stream was delivered directly to the bioassay laboratory for testing. Also, a portion of the chlorinated effluent was dechlorinated with sulfur dioxide and then pumped to the bioassay laboratory. Measurements were made of: total and fecal coliform densities, total suspended solids, volatile solids, COD, ammonia nitrogen, phosphate, turbidity, color, and pH. Also, each of the five waste water streams was tested for acute toxicity towards several species of fish and invertebrates and chronic toxicity in a life cycle study with the fathead minnow (Pimephales promelas). Ozone was nontoxic to fish in concentrations in waters after disinfection, sulfur dioxide eliminated the toxicity of chlorine, and bromine chloride was less toxic than chlorine. Lack of a reliable method for pacing ozone dosages impaired the disinfection effectiveness of ozone. (See also W77-11762) (Small-FIRL)
W79-06509

EFFECT OF GEOGRAPHY ON THE EXTENSIVE AGRICULTURAL USE OF SEWAGE,
Army Terrestrial Sciences Center, Hanover, NH.
J. Wierzbicki.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A044 765, Price codes: A02 in paper copy, A01 in microfiche. Draft Translation 642, 1977. 6 p, 2 tab. Translated from Gaz Woda Technika Santarna, Vol. 24, No. 11, p 407-410. 1950.

Descriptors: *Waste water treatment, *Municipal wastes, *Agriculture, Soils, Climates, *Europe, *Irrigation, Waste water disposal, Toxicity, Return flow.

Waste water treatment through application of the water to agricultural lands is limited by various soil and climatic conditions. This method has been largely abandoned in England because of the generally heavy soil and the long growing season. Also, due to heavy industrialization, English municipal waste water often contains chemicals which are harmful or toxic to plants. In Central Europe, the conditions are favorable for waste water irrigation. There is an insufficient amount of precipitation during the growing season, the soil is generally permeable, there is an abundance of light, and the waste water is generally suitable for agricultural use. This method is common in Poland. (Small-FIRL)
W79-06534

AIR POLLUTION ASPECTS OF SLUDGE INCINERATION.
Environmental Protection Agency, Cincinnati, OH.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-259 457, Price codes: A02 in paper copy, A01 in microfiche. Report EPA-625/4-75-009, 1975. 16 p, 4 fig, 6 tab, 12 ref.

Descriptors: *Incineration, *Sludge disposal, *Air pollution, *Municipal wastes, Clean Air Act, *Opacity, Mercury, Sulfur compounds, Pesticides.

Incineration reduces sludge to a sterile landfill and removes offensive odors, but it can cause air pollution problems. Existing, well-designed municipal waste water sludge incinerators are capable of meeting stringent standards. When particulate emission was studied, no relationship was found between mass emission rates of particulates and the percent of rated capacity at which the incinerator was operating, but a strong relationship was found between pressure drop across the scrubber and mass emission rates. The cost of the scrubbing systems was usually about 4% of the cost for the facility, and all plants tested easily met the opacity standard. No known existing plants approach the national emission standard for Hg. Possible gaseous pollutants include HCl, SO2, NOX, and CO. Again, properly operated incinerators did not exceed the limits for these pollutants. For some pesticides containing sludges, afterburners may be needed to achieve total destruction of the pesticides. (Small-FIRL)
W79-06540

CHARACTERIZATION OF PRIORITY POLLUTANTS FROM A SECONDARY LEAD AND BATTERY MANUFACTURING FACILITY,
Battelle's Columbus Lab., Columbus, OH.
E. J. Mezey.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-293 171, Price codes: A03 in paper copy, A01 in microfiche. Report EPA-600/2-79-039, January 1979. 41 p, 2 fig, 10 tab, 1 ref, 1 append.

Descriptors: *Metals, *Lime, *Flocculation, *Settling basins, *Slurries, Copper, Zinc, Lead, Cadmium, Mercury, Chromium, Nickel, Waste water treatment, Industrial wastes.

An evaluation of a lime and settling treatment of effluent from a manufacturing plant producing secondary lead from old batteries was conducted according to EPA protocol procedures for priority pollutants. The treatment process mixes 3,738 lbs dry lime/day with 410,500 gpd of influent waste water. The slurry is then fed to a second reaction tank where it is treated with a flocculating agent at a rate of 3.8 liters/min to promote flocculation and crystal growth. The waste water then undergoes clarification and settling before discharge to a receiving stream. Underflow is thickened to 5% solids and landfilled. The treatment process reduced copper by 75.0%, zinc by 91.0%, lead by 95.0%, cadmium by 73.0%, and mercury by 100.0%. Benzene and cyanide concentrations were reduced to below their detection limits; phenols were below detection limits in both influent and effluent. The removal of antimony, chromium, and nickel from the waste water could not be evaluated with any degree of confidence because of extremely low concentrations of these metals. (Lisk-FIRL)
W79-06541

DEVELOPMENT AND PRESENT CONDITION OF SEWAGE TREATMENT AND UTILIZATION IN BERLIN,
Army Terrestrial Sciences Center, Hanover, NH.
K. Weiland.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A046 780, Price codes: A11 in paper copy, A01 in microfiche. Draft Translation 655, 1977. 17 p, 5 fig. Translated from Wasserwirtschaft-Wassertechnik Vol. 7, p 229-235, July 1955.

Descriptors: *Municipal wastes, *Europe, *Agriculture, *Waste water treatment, *Sewage treatment, Sewerage, Settling basins, Performance, Irrigation, Return flow.

The development and utilization of the sewage treatment system of the city of Berlin, Germany as of 1955, are reviewed. Berlin's sewage treatment system began in 1878 when its first sewer system began operation. Sewage was processed on agricultural lands. In 1928, the Municipal Drainage System utilized 23,036 hectares excluding woodlands. Of these, 10,708 hectares were used for drainage and the remaining areas were channel, water, and gardening surfaces. In 1953, 17,900 hectares were in use. In 1955, there were 654 settling basins in operation. The settling cycle for the basins ranged from one to one and one half hours, and the degree of purification was 70 to 95%. The design of several drainage areas is described. (Small-FIRL)
W79-06546

CONTAMINANTS ASSOCIATED WITH DIRECT AND INDIRECT REUSE OF MUNICIPAL WASTEWATER.
SCS Engineers, Long Beach, CA.
For primary bibliographic entry see Field 5C.
W79-06567

WATER QUALITY MANAGEMENT GUIDE FOR MINE-RELATED POLLUTION SOURCES (NEW, CURRENT AND ABANDONED),
Environmental Protection Agency, Washington, DC. Nonpoint Sources Branch.
D. Deely.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-280 625, Price codes: A10 in paper copy, A01 in microfiche. Report No EPA-440/3-77-027, December 1977. 198 p, 16 fig, 6 tab, 88 ref, 2 append.

Descriptors: *Mine drainage, *Water quality control, *Management, *Planning, Water pollution sources, Water Pollution Control Act Amendments of 1972, Mine wastes, Surface runoff, Erosion control, Water pollution control, Pollution abatement, Mine acids, Mine water, Programs.

Suggested work plan tasks and task sequences are offered as guidance to State and areawide water quality management (WQM) agencies dealing with mine-related sources of pollution as directed under Public Law 95-87, the Surface Mining Control and Reclamation Act of 1977. The aspects of the mine-related water quality management plan, discussed and explained separately, include: (1) identification and assessment of existing current and abandoned sources; (2) current source control; (3) identification and use of best management practices; (4) abandoned source abatement; (5) new source planning; and (6) continuing management and WQM planning. The mining regulatory control system features needed for effective water pollution prevention and control, basic mining water pollution control principles, and distinctions between point sources and nonpoint sources are discussed. (Davison-IPA)
W79-06568

STUDY AND ANALYSIS OF THE APPLICATION OF SALINE WATER CONVERSION PROCESSES TO ACID MINE WATERS,
Maryland Univ., College Park. Dept. of Chemical Engineering.
For primary bibliographic entry see Field 3A.
W79-06574

STUDY ON THE EFFECTIVENESS OF DISINFECTING SEWAGE CONTAINING TUBERCULOSIS BACILLI WITHOUT BIOLOGICAL TREATMENT,
W. Dozanska, and W. Manowska.
Available from the National Technical Information Service, Sringfield, VA 22161, as ORNL-tr-4364, Price codes: A 02 in paper copy, A01 in microfiche. Translatd from Panstwowy, Zaklad nigreny. Roczinki. Translation 1977. 12p, 4 tab, 19 ref. Warsaw Vol 23, No 3, 1972.

Descriptors: *Disinfection, *Chlorination, *Sewage treatment, Sewage bacteria, *Bacteria, Waste treatment.

The possibility of effective disinfection of sewage containing tuberculosis bacilli by means of mechanical purification without biological treatment was investigated. Laboratory tests were performed on the influence of various suspensions upon destruction of bacilli in an aqueous environment using chlorine. Mechanical treatment and disinfection by chlorine were effective. When residual chlorine levels were 5 mg/liter Cl after 60 min, destruction of the tubercle bacilli approached 100%. Using this method, chlorine demand was 1.8 times greater than after biological purification. Virulent strains of tubercle bacillus were detected in sewage using various biological methods and guinea pigs. (Small-FIRL)
W79-06584

PAPERMILL EFFLUENT TURBIDITY REMOVAL -- A NEW APPROACH,
J. Delaine.
Effluent and Water Treatment Journal, Vol. 18, No. 5, p 219-221, 223, May, 1978. 2 fig, 4 ref, 3 tab.

Descriptors: *Pulp wastes, *Waste water treatment, *Turbidity, Wastes, Industrial wastes, Waste

treatment, Water pollution treatment, Water pollution sources, Pulp and paper industry, Effluents, Sedimentation, Separation techniques, Flocculation, Sludge, Enzymes, Clays, Electrolytes, Polyelectrolytes, Lime, Sea water, Aluminum sulfate, Manganese sulfate.

Rising water treatment and effluent treatment costs have directed considerable attention to the closure of water systems within the paper industry. Coupled with the increasing use of secondary fibers in paper mills, this often leads to new problems in effluent treatment, particularly higher concentrations of starch-stabilized fines in the effluent. Clarification by conventional means may be difficult. New and modified effluent sedimentation procedures are evaluated, namely, the sludge contact process in which preformed flocs of sludge are mixed with the incoming chemical-dosed feed, enzyme-assisted aluminum sulfate flocculation (e.g., alpha-amylase), replacement of aluminum sulfate by a bentonite/high-molecular weight polyelectrolyte system for flocculation, and the addition of hydrated manganese sulfate directly or indirectly (i.e., contained in sea water) during lime treatment. (Swichtenberg-IPC)
W79-06620

METHOD FOR THE TREATMENT OF SEA DISCHARGED SEWAGE,
Hydrotechnic Corp., NY. (Assignee).
R. Nebolsine.
U.S. Patent No. 4,128,477, 7 p, 1 fig, 8 ref; Official Gazette of the United States Patent Office, Vol. 977, No. 1, p 201, December 5, 1978.

Descriptors: *Patents, *Waste water treatment, *Sewage treatment, *Water pollution treatment, Waste water disposal, Sewage effluents, Filtration, Coagulation, Oxidation, Separation techniques, Ocean disposal, Outfalls.

A method is disclosed for treating sewage destined for discharge into the sea. The fluid treatment process comprises conducting the sewage through bar racks, and degritters to remove large scale particles, extracting intermediate size particulate material in a rotary drum screen, introducing a chemical composition into the fluid to promote coagulation of particles having an average particle size of less than about 1 micron, filtering the fluid containing the coagulated particles through a deep bed multi-media filter, adjusting the quantity of dissolved oxygen in the filtrate to a predetermined level and discharging the oxygenated fluid to the sea some distance offshore to permit dispersal of any remaining contaminants by action of wind and currents. (Sinha-OEIS)
W79-06623

OZONE DISINFECTION IN WASTE WATER TREATMENT WITH RECYCLING OF OZONATION OFF GAS,
FMC Corp., Chicago, IL. (Assignee).
W. P. Key, D. C. Ihrig, and D. W. Monroe.
U.S. Patent No. 4,132,637, 22 p, 11 fig, 6 ref; Official Gazette of the United States Patent Office, Vol. 978, No. 1, p 233-234, January 2, 1979.

Descriptors: *Patents, *Waste water treatment, *Sewage treatment, *Water pollution treatment, *Disinfection, Activated sludge, Ozone, Gases, Equipment.

A method of recycling the off gas from an ozone disinfection step used with an activated sludge waste water treatment system and apparatus for carrying out the method is described. In recent years the treatment of the effluent of effluent of sewage treatment plants - in the form of air or oxygen containing a few percent of ozone - has been widely used as an alternative to chlorination. Ozonation of sewage treatment plant effluent has been found to be very effective for disinfection of the effluent. The moisture is removed from a substantial portion but not all of the ozonation off gas, while the nitrogen and carbon dioxide contaminants that are contained in the off gas are left in it. The dried off gas is mixed with oxygen enriched gas from the original source, and the resulting mixture is delivered to the ozone generator for the production of more ozone. Another portion of the ozonation off gas is diverted upstream for introduction into the oxygen treatment facility of the activated sludge treatment plant. (Sinha-OEIS)
W79-06624

PROCESS FOR THE HYGIENIC ELIMINATION OF SEWAGE CONTAINING SALT-CONTAINING ORGANIC SUBSTANCES,
Von Roll A. G., Gerlafingen (Switzerland). (Assignee).
E. Filzmoser.
U.S. Patent No. 4,132,640, 6 p, 1 fig, 6 ref; Official Gazette of the United States Patent Office, Vol 978, no 1, p 235, January 2, 1979.

Descriptors: *Patents, *Waste water treatment, *Sewage treatment, *Industrial wastes, *Organic wastes, Water pollution treatment, Separation techniques, Incineration, Gases, Equipment, Oxidation, Combustion chamber.

A process is described where the concentrated industrial sewage is initially finely atomized, its remaining water percentage is evaporated by means of a hot gaseous medium accompanied by direct contact and as a result the dry substance in the sewage is separated. The thus obtained dry substance is pneumatically fed into a hot combustion chamber by means of an oxygen-containing carrier gas. Due to the rapid heating the salt suddenly passes into the gaseous phase without salt fusion and the organic substances are oxidized. The hot flue gases formed during the combustion of the organic substances and the salts in the gas phase are removed from the combustion chamber and rapidly cooled by means of air or water or both. The salts are removed from the flue gases which are discharged into the atmosphere. (Sinha-OEIS)
W79-06625

SLUDGE AND SLIME SEPARATING AND SETTLING DEVICE,
A. O. V. Hellqvist.
U.S. Patent No. 4,132,643, 5 p, 1 fig, 6 ref; Official Gazette of the United States Patent Office, Vol 978, no 1, p 236, January 2, 1979.

Descriptors: *Patents, *Waste water treatment, *Domestic wastes, *Water pollution treatment, Separation techniques, Slimes, Sludge, Solid wastes, Equipment.

This invention is related to a sludge and slime separating and settling device for treating all kinds of domestic waste water effluents. It is comprised of a container with a bottom and a lower, truncated conical part, an upper, truncated conical part with a spillover overflow extending around the upper edge, and an intermediate cylindrical part. The inlet is in the vertical direction in the middle of the container. The container is closed with a cover provided with an annular flow barrier wall extending from above the overflow level and dipping into the container. The device is preferably prepared from a plastic material, such as polyethylene or polypropylene. (Sinha-OEIS)
W79-06626

TWO-STAGE OIL SKIMMER SEPARATOR,
Sun Oil Co., Philadelphia, PA. (Assignee).
J. C. Bottomley, and H. G. Nash.
U.S. Patent No. 4,132,645, 5 p, 4 fig, 5 ref; Official Gazette of the United States Patent Office, Vol 978, no 1, p 237, January 2, 1979.

Descriptors: *Patents, *Waste water treatment, *Industrial wastes, *Oil pollution, Water pollution treatment, *Separation techniques, Skimming, Heat treatment, Equipment, Oil refinery, Gravity separation.

A Two stage oil skimmer separator for separating a hydrocarbon, such as oil or wax, from the water in a hydrocarbon-water mixture is of particular utility for the output from an oil refinery storm sewer system. The first stage of the separator includes a tank which allows gravity separation of the hydrocarbon and water. The floating hydrocarbon is skimmed off the top and directed to a second stage separator. The settled water passes under a baffle to retain the hydrocarbon within the system while passing the water out of the separator. The skimmed hydrocarbon, containing some water, is directed to the second stage where it is heated to facilitate further separation. The hydrocarbon is passed from the top of the second stage to storage tanks in the refinery. The water in the bottom of the second stage tank is returned to the first stage for further separation. (Sinha-OEIS)
W79-06627

AGENT FOR REMOVING HEAVY METALS,
Chisso Corp., Osaka (Japan). (Assignee).
R. Tarao, K. Kaku, M. Hayashi, T. Nakamura, and S. Ohishi.
U.S. Patent No. 4,133,755, 11 p, 10 tab, 3 ref; Official Gazette of the United States Patent Office, Vol. 978, No. 2, p. 613, January 9, 1979.

Descriptors: *Patents, *Waste water treatment, *Industrial wastes, *Heavy metals, *Mercury, Water pollution treatment, Absorption, Granules, Dithiocarbamate compounds.

Heavy metals such as mercury are removed from waste water by passing the waste water through a column packed with a granulated product containing a dithiocarbamate compound, amorphous silica and active carbon powder. The granulated product is obtained by blending and shaping these materials together with a binder composed mainly of vinyl acetate polymer resin and an excipient composed mainly of clay. The granulation method is carried out by blending a composition consisting of a dithiocarbamate bond-containing low molecular weight compounds, active carbon powder and amorphous silica with water, an excipient composed mainly of a clay and a binder composed mainly of vinyl acetate polymer resin to obtain a blend having a water content of 25-35%, which is then subjected to extrusion-granulation. (Sinha-OEIS)
W79-06632

PROCESS FOR PURIFICATION OF WASTE WATER PRODUCED BY A KRAFT PROCESS PULP AND PAPER MILL,
National Aeronautics and Space Administration, Washington, DC. (Assignee).
M. F. Humphrey.
U.S. Patent No 4,134,786, 6 p, 1 fig, 3 ref; Official Gazette of the United States Patent Office, Vol 978, No 3, p 968, January 16, 1979.

Descriptors: *Patents, *Waste water treatment, *Water pollution treatment, *Pulp wastes, Pulp and paper industry, Chemical reactions, Chemical precipitation, Separation techniques, Activated carbon, Lignins, Product recovery.

A method and means for purifying the waste water from paper and pulp mill wastes obtained from a mill using the Kraft process is described. First the lignins and lignin derivatives are precipitated from the waste stream with quaternary ammonium compounds. Next other impurities are removed by activated carbon produced from the cellulosic components of the water and then water is separated from the precipitate and solids. The activated carbon also acts as an aid to the separation of the water and solids. If recovery of lignins is also desired, then the precipitate containing the lignins and quaternary ammonium compound is dissolved in methanol. Upon acidification, the lignin is precipitated from the solution. The methanol and quaternary ammonium compound are recovered for reuse from the remainder. (Sinha-OEIS)
W79-06638

METHOD OF PURIFYING WASTE WATER,
Swenska Sockerfabriks AB, Malmo. (Assignee).
H. Skogman, and L. Huss.
U.S. Patent No 4,134,830, 5 p, 2 fig, 8 ref; Official Gazette of the United States Patent Office, Vol 978, No 3, p 981-982, January 16, 1979.

Descriptors: *Patents, *Waste water treatment, *Water pollution treatment, *Organic wastes, Carbohydrates, Proteins, Biological treatment, Anaerobic conditions, Aerobic conditions, Activated sludge, Separation techniques, Sludge treatment, Sugar industry.

A method of purifying waste water rich in carbohydrates or proteins is based on biological purification in two stages, a first anaerobic stage and a second aerobic stage. In the anaerobic stage the sludge content is kept at a high level, while selecting the conditions so that methane fermentation with subsequent reduction of the pollutants is obtained. Water containing sludge, formed in the anaerobic stage, is subsequently exposed to sludge separation while forming a first sludge concentrate which is returned to the anaerobic stage, i.e., it is recirculated. After the sludge separation, the water treated in the first stage is treated in the aerobic stage, where remaining pollutants, thanks to the conversion in the anaerobic stage, are present in such a form, that they can easily be utilized by aerobic organisms. The sludge-bearing water formed in the aerobic stage is subjected to sludge separation while forming a second sludge concentrate at least a portion of which is returned to the aerobic stage while possible surplus is recirculated to the anaerobic stage. Sludge from the first sludge concentrate and possibly also from the second sludge concentrate is drawn off and taken away for disposal. (Sinha-OEIS)
W79-06639

WATER RECYCLE UNIT-GREY WATER CLEARIFIER,
D. J. McCormick.
U.S. Patent No 4,134,833, 6 p, 3 fig, 6 ref; Official Gazette of the United States Patent Office, Vol 978, No 3, p 982, January 16, 1979.

Descriptors: *Patents, *Waste water treatment, *Water pollution treatment, *Water reuse, Water purification, Domestic water, Separation techniques, Recycling, Filtering, Grey water, Settling.

The primary object of this invention permits water to be recycled indefinitely for certain operations, such as washing, so that the overall, total use of water in households, and in certain industries can be substantially reduced. A water recycle unit for producing clear water output from grey water input comprises a container which has sufficient capacity to provide the time required for the grey water input to go through all of the physical changes needed to provide a clear water output. These physical changes include the settling of heavy materials, such as sand and dirt, to a lower zone and the rising of lighter materials, such as oil and fibers, to an upper zone to leave a central zone of clear water between the lower and upper zones within the container. The container includes outlet openings located in a side wall of the container at a level which is normally above the upper side of the zone of clear water within the container. A gate within the interior of the container includes a closed passageway for removing clear water from the central zone through the outlet in response to the inflow of additional grey water. A clear water collecting and filter box is built alongside of and integrally with the container. (Sinha-OEIS)
W79-06641

MONITORING PROGRAM NEEDED FOR WISE TREATMENT CHOICES,
Beak Consultants Ltd., Vancouver (British Columbia).
For primary bibliographic entry see Field 5A.
W79-06722

OIL/WATER SEPARATION: STATE-OF-THE-ART,
Rutgers - the State Univ., New Brunswick, NJ. Dept. of Chemical and Biochemical Engineering.
F. A. Osamor, and R. C. Ahlert.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-280 755, Price codes: A06 in paper copy, A01 in microfiche. Report No. EPA-600/2-78-069, April 1978. 106 p, 10 fig, 4 tab, 176 ref. R803978.

Descriptors: *Waste water treatment, *Water pollution treatment, *Oil spills, *Oil pollution, Oil wastes, Water pollution sources, Oily water, Filtration, Membrane processes, Reverse osmosis, Adsorption, Separation techniques, Absorption, Specifications, Chromatography.

Devices and processes for oil/water separation are classified into 11 categories according to the primary mechanism inducing the separation. The characterization of oil/water systems is examined, followed by a parallel characterization of oily waste waters. The basic principle of each category of devices or processes and the specific design features, operational modes, and limitations are discussed. Literature on test evaluation of a number of devices is reviewed on the basis of actual or potential success in treating oil/water system conditions. No single technique is capable of separating all oil/water system conditions efficiently, although reverse osmosis, ultrafiltration, and carbon adsorption have great potential. The high equipment and operation costs of these limit their use for treating oily waste streams. For production of effluents with the desired discharge quality of less than 10 ppm of oil, a combination of devices in a process change is necessary. The specific characteristics of an oily waste water regulate the combination of devices that give the required effluent concentrations. (Davison-IPA)
W79-06775

PROCEEDINGS, FIFTH UNITED STATES/JAPAN CONFERENCE ON SEWAGE TREATMENT TECHNOLOGY,
Environmental Research Center, Cincinnati, OH.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-279 216, Price codes: A08 in paper copy, A01 in microfiche. Report No. EPA-600/9-77-027, December 1977. Conference held in Tokyo, Japan, April 18-22, 1977. 578 p, 282 fig, 186 tab, 339 ref.

Descriptors: *Conferences, *Sewage treatment, *Industrial waste treatment, Water pollution treatment, Activated carbon, Filtration, Technology, Government finance, Water quality control, Management, Water reuse, Run-off, Combined sewers, Sewage, Water pollution control, Monitoring.

The 16 papers presented at a joint U.S.-Japan conference on sewage treatment technology are compiled. The five Japanese papers describe industrial waste water control into public sewers, storm and combined sewer overflows; regeneration of granular activated carbon; deep aeration tanks; upgrading existing plants by chemical addition to aeration tanks; and rapid sand filtration process for tertiary purpose. The topics covered by the U.S. series of papers includes control of non-point source pollution; use of new technology in the EPA Construction Grant Program; Georgia's water quality control program Federal-State-regional participation in the development of a waste water management plan; regional domestic waste water management; urban run-off pollution control technology; waste water reuse; industrial waste water pre-treatment and joint treatment; criteria and assessment of waste treatability; biological nitrogen and phosphorus control; and water reclamation technology. It is concluded that the technology exchange program and conference were valuable to both countries. (Davison-IPA)
W79-06779

RECENT DEVELOPMENTS IN THE SANDIA LABORATORIES' SEWAGE SLUDGE IRRADIATION PROGRAM,
Sandia Lab., Albuquerque, NM.
H. D. Sivinski, J. R. Brandon, M. E. Morris, K. S. Neuhauser, and R. L. Ward.
Available from the National Technical Information Service, Springfield, VA 22161 as SAND-77-1411, Price codes: A04 in paper copy, A01 in microfiche. Report no. SAND-77-1411, November 1977. 70p, 14 fig, 23 tab, 33 ref. AT(29-1)-789.

Descriptors: *Sludge treatment, *Irradiation, *Heat treatment, *Sludge disposal, Waste storage, Bacteria, Viruses, Pathogenic bacteria, Feeds, Dewatering, Laboratory tests, Investigations, Waste treatment, Sludge, Organic wastes, Liquid wastes.

Recent pathogen reduction work, sludge processing costs, agronomics and animal refeeding studies, and product enhancement and physical/chemical effects are reviewed. Studies show that irradiation with 1 Mrad effectively eliminates pathogenic bacteria and viable parasite ova in liquid sludges. Heat is effective in reducing the levels of pathogenic bacteria, Ascaris ova, and viruses. Ammonia was shown to be virucidal to poliovirus and other enteric viruses. That effects of irradiation of sludges on dewatering properties are not significant compared to polymers was shown by physical/chemical effects studies. When used as a feeding supplement for sheep and cattle, dried irradiated undigested sludge was shown to have significant nutritional value; no significant harmful effects have been demonstrated in this feeding program. Most of the work reported has been done in liquid sludges, but the emphasis in the program has shifted to the treatment of dried sludges. A status report on the dried sludge irradiator being built is included. (Davison-IPA)
W79-06782

MARKETING FEASIBILITY OF USING CEDAR MILL WASTE FOR OIL SPILL CLEAN-UPS,
Northern Maine Regional Planning Commission, Caribou.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-279 476, Price codes: A04 in paper copy, A01 in microfiche. Final Report No. EDA 78-059, February 1978. 54 p, 10 append. 01-6-01535.

Descriptors: *Oil spills, *Water pollution, *Water pollution abatement, Waste treatment, Recycling, Industrial wastes, Water pollution treatment, Absorption, Marketing techniques, Wood wastes, Research and development, Specifications.

An excelsior product developed from cedar mill wastes has the potential for use in oil spill clean-ups and industrial oil-type removal processes. The first step in a three-phase market study involved drawing up a list of specifications as best as could be done without controlled laboratory testing. The specifications covered all the important areas concerning oil spill clean-up such as product density, absorption, efficiency, and disposability. The specification information was obtained through using a small testing tank at the lumber company where the product was developed. The second step of the study involved developing the questionnaire which consisted of seven questions on the market potential of the product and its packaging. The third step was the development of an introductory letter explaining the project and the most important aspects of the proposed product. The market study package was sent to interested contractors. This cedar residue has a very high absorption ratio compared with other absorbents used today. Lake, pond, and stream oil spills; industrial transfer accidents; and small oil spills on the open sea and around docks are some possible uses for this product. (Davison-IPA)
W79-06788

FULL-SCALE DEMONSTRATION OF NITROGEN REMOVAL BY BREAKPOINT CHLORINATION,
Stone (Richard W.) Sacramento, CA.
R. W. Stone.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-280 657, Price codes: A05 in paper copy, A01 in microfiche. Report No. EPA-600/2-78-029, March 1978. 80 p, 31 fig, 7 tab, 6 ref, 2 append. S-803343-01-0.

Descriptors: *Waste water treatment, *Chlorination, *Evaluation, On-site investigations, Chemical reactions, Alkalinity, Design criteria, Ammonia, Nitrogen, Oxidation, Nitrates, Water pollution

sources, Water purification, Water pollution treatment, Water pollution control, Water quality control, Water treatment, Municipal wastes, Rancho Cardova(California).

A large-scale demonstration program was carried out to establish design and operating criteria of breakpoint chlorination for nitrogen removal systems for use in municipal waste water treatment applications. Breakpoint chlorination process chemistry is discussed, chemical consumption is evaluated, and process control recommendations are made. The theoretical dosage of chlorine required to convert 1.0 mg/l of ammonia nitrogen to nitrogen gas is 7.6 mg/l; an average dosage of 10 mg/l chlorine was required in the process evaluated. The difference between these dosages was due to chlorine consumption from the oxidation of ammonia nitrogen to nitrate nitrogen which is a competing side reaction having a less desirable end product. About 96% of the chlorine dosed to the system was accounted for in reactions between chlorine and nitrogenous species in specific, identified chemical pathways, and as free chlorine remaining in solution following breakpoint. The rate of the breakpoint reaction varied depending on the system pH; the fastest rates were at a pH of 7.0. This evaluation showed that the process requirement for alkalinity supplementation was nearly exactly equal to that predicted from the chemical stoichiometry. (Davison-IPA)
W79-06791

DESIGN OPTIMIZATION OF HIGH-RATE DISINFECTION USING CHLORINE AND CHLORINE DIOXIDE,
O'Brien and Gere Engineers, Inc., Syracuse, NY.
D. F. Geisser, S. R. Garver, and C. B. Murphy, Jr.
Journal of the Water Pollution Control Federation, Vol 51, No 2, p 351-357, February 1979. 9 fig, 3 tab, 15 ref.

Descriptors: *Design, *Optimization, *Disinfection, *Effects, *Regression analysis, *Waste water treatment, *Chlorine compounds, Performance, Coliforms, Evaluation, Equations, Mathematical models, Systems analysis, Cost minimization, Cost effectiveness.

Pilot-plant treatability studies of high-rate disinfection with chlorine and chlorine dioxide were conducted in Rochester, New York as part of the Combined Sewer Overflow Abatement Program for the Monroe County Division of Pure Waters. Using data acquired during the pilot-plant investigations, mathematical performance models were developed for both chlorine and chlorine dioxide disinfection cost and performance comparisons of chlorine and chlorine dioxide for several alternative treatment systems. Optimization analysis results indicated that a high-rate disinfection system using short detention times and high-intensity mixing appears to be a more cost-effective technique than either a corrugated baffle or conventional system for the disinfection of Rochester combined sewer overflows. In general, the use of chlorine is preferred over chlorine dioxide on a cost-performance basis. (Bell Graf-Cornell)
W79-06803

PUTTING SLUDGE TO WORK.
Ground Water Age, Vol. 13, No. 8, p 22, April, 1979. 1 fig.

Descriptors: *Water reuse, *Recycling, Sludge disposal, Sewage treatment, Waste water(Pollution), Groundwater, Water quality.

A unique approach to wastewater renovation, developed by Michigan State University, uses a system of lakes, marshes, and irrigation in conjunction with a conventional wastewater treatment plant. The advantages of this system are that biological materials can be harvested and used, nutrients can be recycled, and municipal wastewater can be cleaned in a process that requires no pretreatment and uses solar energy. Lake vegetation absorbs nutrients in the wastewater and is harvested for compost or animal feed. Water from the lakes is applied to a nearby land system through spray irrigation. The MSU system has an extensive array of wells to monitor ground water quality. This system promises to be economical both on a short-term and a long-term basis. However, it may not be practical for large communities due to the land areas required. (Purdin-NWWA)
W79-06805

BIOLOGICAL TREATMENT, EFFLUENT REUSE, AND SLUDGE HANDLING FOR THE SIDE LEATHER TANNING INDUSTRY,
Polkowski, Boyle and Associates, Madison, WI.
L. B. Polkowski, W. C. Boyle, and B. F. Christensen.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-280 676, Price codes: A12 in paper copy, A01 in microfiche. Report No. EPA-600/2-78-013, February 1978. 246 p, 88 fig, 83 tab, 6 ref, 3 append. 12120 DSG.

Descriptors: *Biological treatment, *Industrial wastes, *Tannery wastes, *Evaluation, Sludge disposal, Waste treatment, Water reuse, Water pollution treatment, Water conservation, Leachate, Chemical analysis, Effluents, Liquid wastes, Water pollution, Solid wastes.

The treatability of unsegregated, unequalized, unneutralized waste waters from a side-leather tanning industry using the hair pulping process by primary and secondary biological treatment methods is evaluated. Screening and gravity separation in clarifier-thickeners comprised the primary treatment; the secondary treatment method utilized aerated ponds and final clarifiers capable of recycling biological solids. The system was operated over a wide range of detention times during seasonal variations with monthly temperature ranges from -14C to 30C, and with and without solids recycle and nutrient addition. Generally, the results indicated that the system is unable to meet the Best Practicable Treatment and Best Available Treatment guidelines which served as a comparison. Except for oil and grease, the raw waste water characteristics for this type of processing were within EPA guideline limitations. In evaluating the effects of water conservation practice on leather qualities and to determine conservative substances buildup in the waste water effluent, the secondary treatment effluent was used in the beamhouse operations under test conditions. (Davison-IPA)
W79-06865

TREATMENT AND RECOVERY OF FLUORIDE AND NITRATE INDUSTRIAL WASTES: PHASE II,
Grumman Aerospace Corp., Bethpage, NY.
C. J. Staebler, Jr.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-281 159, Price codes: A05 in paper copy, A01 in microfiche. Final Report No. EPA-600/2-78-048, March 1978. 85 p, 29 fig, 18 tab, 26 ref. S800680.

Descriptors: *Waste water treatment, *Industrial wastes, *Byproducts, Fluorides, Nitrates, Ion exchange, Effluents, Centrifugation, Water purification, Calcium compounds, Fertilizers, Analytical techniques, Sludges, Equipment, Evaporators, Water pollution treatment, Waste treatment, Sludge treatment.

The laboratory and pilot-scale techniques described were developed to treat selected chemical processing solutions and rinse waters containing fluorides, nitrates, and to recover usable byproducts. The following lime treatment parameters were optimized for various fluoride and nitrate effluent levels: temperature, retention time, pH, and slurry concentration. Ion exchange techniques which reduced rinse water concentrations of fluoride to 3 ppm and nitrate to 10 ppm were developed. Pilot-scale centrifugal techniques were developed to separate calcium fluoride and metal hydroxide sludges. In the optimized pilot-scale system the nitrate concentration of centrifuged effluents was reduced from 28,000 to less than 5 ppm by passing these effluents through a thin film, mechanically aided evaporator. The pilot treatment system reduced fluoride concentration from 117,000 to less than 1 ppm. Chemical and mechanical property tests revealed that calcium fluoride sludge is potentially feasible as a strength-maintaining additive for concrete. Greenhouse tests indicated that concentrated calcium nitrate recovered from the mechanically aided evaporator is a beneficial and practical plant fertilizer. The economics and production scale-up plans for ion-exchange rinse water treatment and process treatment are presented. (Davison-IPA)
W79-06869

EVALUATION OF THE RBC PROCESS FOR MUNICIPAL WASTEWATER TREATMENT,
Pewaukee, WI.
D. L. Kludge, R. J. Kipp, and C. J. Crandall.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-280 496, Price codes: A06 in paper copy, A01 in microfiche. Final Report No. EPA-600/2-78-028, March 1978. 104 p, 48 fig, 62 tab, 9 append. S802905.

Descriptors: *Waste water treatment, *Rotating biological contactor, *Trickling filter, Nitrification, Phosphorus, Biochemical oxygen demand, Suspended solids, Treatment facilities, Water pollution treatment, Water quality standards, Evaluation, Pewaukee(Wisconsin).

The rotating biological contractor (RBC) was operated as a full scale process at the Pewaukee, Wisconsin, waste water treatment plant to determine if it could consistently produce an effluent phosphorus concentration below 1.5 mg/ (total phosphorus) and biochemical oxygen demand (BOD) and suspended solids (SS) levels below 15 mg/l. In Phase I the effectiveness and efficiency of the process was demonstrated, evaluated, and compared with a parallel 1136 m3/day (0.30 mgd) trickling filter. Superior BOD and SS values were obtained with the RBC process, but better nitrification was obtained with the trickling filter. In Phase II phosphorus removal was demonstrated and evaluated; treatment was upgraded by the addition of alum and ferric chloride to the RBC process at two feed points upstream and downstream from the RBC units. The results indicated that although the mineral addition improved RBC phosphorus removal, the BOD and SS values of the effluent deteriorated. This occurred regardless of the location of the mineral addition or the cation species used for phosphorus removal. It is concluded that the RBC process effluent met and exceeded the secondary treatment standards, and that it gave a superior effluent quality regarding BOD and total SS than the trickling filter. (Davison-IPA)
W79-06872

SORBENTS FOR FLUORIDE, METAL FINISHING, AND PETROLEUM SLUDGE LEACHATE CONTAMINANT CONTROL,
New Jersey Inst. of Tech. Newark.
P. C. Chan, R. Dresnack, J. W. Liskowitz, A. Perna, and R. Trattner.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-280 696, Price codes: A05 in paper copy, A01 in microfiche. Final Report No. EPA-600/2-78-024, March 1978. 93 p, 30 fig, 12 tab, 18 ref. R803717.

Descriptors: *Sorbents, *Waste treatment, *Leachate, *Industrial wastes, *Sludge, Wastes, Fluorides, Alkalis(Bases), Oil wastes, Clays, Illite, Kaolinite, Activated carbon, Fly ash, Lysimeters, Zeolites, Cullites.

The use of ashes, vermiculite, illite, activated carbon, kaolinite, natural zeolite, activated alumina, and cullite was investigated to determine their capability to remove leachate contaminants produced from the three industrial sludges: calcium fluoride, metal hydroxide, and petroleum. Leachate analysis showed considerable variations in composition and concentration of the constituents in leachate prepared from the same industrial sludge. Batch and lysimeter studies evaluating the static and dynamic sorbent capacity for the leachate constituents revealed that no single sorbent can be used to reduce the concentration of leachate constituents; combinations of two, three, or four

sorbents are capable of reducing them. The combination, activated carbon and activated alumina, was more effective for treating calcium fluoride sludge leachate, and less effective than ash and clay combinations in treating metal finishing and petroleum sludge leachates. The selection of a sorbent combination is sludge leachate specific. Sorbents under dynamic conditions achieved greater capacities for the measured contaminants in the leachates than were achieved under static conditions. Change in pH of the sorbent from acidic to alkaline favored the removal of cations. (Davison-IPA)
W79-06873

COST ALLOCATION FOR A REGIONAL WASTEWATER TREATMENT SYSTEM,
SRI International, Menlo Park, CA.
E. Loehman, J. Orlando, J. Tschirhart, and A. Whinston.
Water Resources Research, Vol. 15, No. 2, p 193-202, April 1979. 3 fig, 6 tab, 22 ref.

Descriptors: *Cost allocation, *Waste water treatment, *Game theory, *Least-cost regionalization, Probability, Systems analysis, Equations, Meramec River basin(Missouri), Effluent dischargers, Economic benefits, Environmental benefits, Economies of scale, Incentives, Shapley value.

There are economies of scale in the construction of regional wastewater treatment systems. Effluent dischargers have the option of participating in a regional system or constructing separate smaller systems. In order to encourage participation in a regional system so that the economies are realized, the cost allocation method employed must offer economic incentives. The cost allocation problem is viewed in game theoretic terms, and the Shapley value (a game theory solution) is suggested as an allocation method. The method is applied to the Meramec River Basin in Missouri where eight dischargers are identified. The problems of application are discussed and the reactions of the eight dischargers are cited. (Bell Graf-Cornell)
W79-06929

WASTEWATER TREATMENT CAPACITY EXPANSION WITH TIME-VARYING ASSIMILATIVE CONSTRAINTS,
TRW Systems Group, Redondo Beach, CA.
J. Baziw, and C. R. Scherer.
Water Resources Research, Vol. 15, No. 2, p 219-227, April 1979. 6 fig, 5 tab, 9 ref.

Descriptors: *Waste water treatment, *Dynamic programming, *Analytical techniques, *Receiving water, *Capacity expansion, *Cost minimization, Standards, Effluents, Constraints, Optimization, Planning, Effects, Discount rate, Equations, Mathematical models, Systems analysis, Equations, Pollutant removal rates, Hydraulic demand.

Optimal waste water plant capacity expansion is reexamined for the general case where effluent receiving water standards vary with time. A deterministic dynamic programming framework is used to determine cost-minimizing expansion plans for waste water treatment when hydraulic demand is assumed known and nondecreasing with time. The effect of discount rate, initial hydraulic capacity, and initial plant pollutant removal rate on expansion plan is investigated. Results show time-variable effluent receiving standards can significantly influence cost-minimizing expansion plans. (Bell Graf-Cornell)
W79-06930

HANDLING AND DISPOSAL OF SLUDGES FROM COMBINED SEWER OVERFLOW TREATMENT: PHASE III--TREATABILITY STUDIES,
Envirex, Inc., Milwaukee, WI. Environmental Sciences Div.
R. Osantowski, A. Geinopolis, R. E. Wullschleger, and M. J. Clark.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-281 006, Price codes: A12 in paper copy, A01 in microfiche. Report No. EPA-600/2-77-053c, December 1977. 272 p, 51 fig, 142 tab, 18 ref, 5 append. 68-03-0242.

Descriptors: *Combined sewers, *Sludge, *Sludge treatment, *Centrifugation, *Anerobic digestion, *Dewatering, Economics, Capital costs, Operating costs, Municipal wastes, Sewage, Sewage treatment, Kenosha, Racine, Milwaukee(Wisconsin).

Results of a project evaluating the handling and disposal of combined sewer overflow (CSO) treatment residuals are reported. At Kenosha, Racine and Milwaukee, Wisconsin, CSO sludges were thickened and dewatered using a mobil centrifuge sludge dewatering van. A bench scale anaerobic digestion system was used to evaluate anaerobic digestion of the sludges. To compare the use of thickening-centrifugation for dewatering CSO sludges and municipal sewage treatment plant sludges, each city's dry-weather treatment plant sludge was also tested using the thickening-centrifugation process. The results indicate dewatering of CSO sludges appears feasible when sludges are first degritted, if required, and thickened before centrifugation. Under optimum centrifuge operating conditions thickened sludges were dewatered to Cake concentrations with solids recoveries ranging from 80% to 99%. The dewatering characteristics of wet-dry weather sludge mixtures at Kenosha were similar to those for CSO sludge alone. According to the bench scale anaerobic digestion studies no significant adverse effect was realized by adding CSO generated sludges to dry-weather digesters at similar feed rates to those expected from a typical storm. Preliminary estimates indicate that first investment capital costs for thickening-centrifugation of CSO sludges ranged from $0.31 million to $2.92 million with annual costs ranging from $49,000 to $659,300/year for handling 4.0 to 36.5 tons/day of dry sludge. (Davison-IPA)
W79-06946

PILOT INVESTIGATION OF SECONDARY SLUDGE DEWATERING ALTERNATIVES,
National Council of the Paper Industry for Air and Stream Improvements, Inc., Kalamazoo, MI.
R. A. Miner, D. W. Marshall, and I. Gellman.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-280 982, Price codes: A07 in paper copy, A01 in microfiche. Report No. EPA-600/2-78-014, February 1978. 126 p, 26 fig, 33 tab, 8 ref, 5 append. R-804019-01-0.

Descriptors: *Sludge treatment, *Pulp and paper industry, *Pulp wastes, *Bleaching wastes, Dewatering, Filtration, Centrifugation, Ultrafiltration, Industrial wastes, Waste treatment, Water pollution sources, Wastes.

The findings of a field investigation are reported in which the following eight pilot dewatering devices were operated on biological sludge from an integrated bleached kraft-fine paper mill: (1) pressure filtration, (2) precoat vacuum filtration, (3) filter belt pressing, (4) multiple role pressing, (5) capillary filter belt pressing, (6) capillary suction dewatering, (7) horizontal bowl centrifuging, and (8) ultrafiltration. Three levels of performance are indicated based upon a criterion of attainable cake consistency: (1) pressure filtration and precoat vacuum filtration generated the driest cakes; (2) filter belt pressing produced cakes of intermediate consistencies; and (3) the low cake consistencies were produced by gravity filtration, centrifugation and ultrafiltration. It was found that performance was severly affected by changes in feed sludge consistency, the amount of sludge conditioning, and the sludge's specific resistance to filtration. The extreme variability of the type and amount of sludge conditioning required depended on the dewatering technique being used, the level of performance expected of it, and the consistency and nature of the sludge being dewatered. (Davison-IPA)
W79-06948

COAST GUARD RESPONSE TO OIL SPILLS--TRYING TO DO TOO MUCH WITH TOO LITTLE,
General Accounting Office, Washington, DC.
E. B. Staats.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-280 911, Price codes: A05 in paper copy, A01 in microfiche. Comptroller General's Report to the Chairman, Subcommittee on Transportation and Related Agencies, Committee on Appropriations United States Senate, May 16, 1978. 85 p, 14 fig, 5 append.

Descriptors: *Oil spills, *Waste water treatment, *Water pollution control, *Pollution abatement, *U S Coast Guard, Coasts, Oil wastes, Monitoring, Legislation, Federal Water Pollution Control Act, Water pollution sources, Water pollution treatment.

During the 1976 Coast Guard effectiveness in containing and cleaning up oil spills in five Coast Guard districts encompassing the Atlantic and Gulf coasts was reviewed. Because of the small quantities of oil spills reported for the Great Lakes, Pacific, and inland Coast Guard districts, they were not reviewed. Coast Guard response to all major and medium oil spills and a sample of minor spill occurring in the districts were analyzed. This analysis includes a chronology of events developed for each spill using Coast Guard, cleanup contractor, and spiller records, and interviews with officials. Coast Guard policies and procedures, training programs, personnel practices, contingency plans and pollution equipment capabilities were also examined. Results of this analysis indicate that the Coast Guard could have been more effective in about 38% of the cases in one or more of the following areas: faster responses to reported spills, better monitoring of cleanup operations, more effective action upon arrival at spills, attempting removal of spilled oil before it dissipates, and investigating reported oil spills of less than 10,000 gallons. The major limitations of the Coast Guard response to oil spills are staff shortages, inadequate training in the pollution abatement program, the need for additional equipment, improvement in its research and development program, and deficiences in contingency planning. (Davison-IPA)
W79-06949

EFFECTS OF DIVERSION AND ALUM APPLICATION ON TWO EUTROPHIC LAKES,
Kent State Univ., OH. Dept. of Biological Sciences.
G. D. Cooke, R. T. Heath, R. H. Kennedy, and M. R. McComas.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-280 983, Price codes: A06 in paper copy, A01 in microfiche. Report No. EPA-600/3-78-033, March 1978. 116 p, 30 fig, 31 tab, 66 ref, 1 append. 16010 HCS, R 801936.

Descriptors: *Eutrophication, *Lakes, *Phosphorus, *Water pollution control, Septic tanks, Water pollution sources, Algae, Trophic level, Limnology, Nutrients, Plankton, Bioindicators, Biomass, Water pollution effects, Epilimnon, Hypolimnon, Ohio.

Diversion of septic tank drainage reduced the symptoms of eutrophication in the East (ETL) and West (WTL) Twin Lakes in Northeastern Ohio. Phosphorus (P) in lakes and streams declined and plankton biomass after diversion, however, during the subsequent five year monitoring period P and biomass remained those of moderately eutrophic lakes and P income remained above the permissable level. It was assumed that the P loading was of hypolimnetic origin, and 139.55 M3 (36,919 gals) of alum were added to the hypolimnion of WTL in July 1975; ETL was used as a downstream control. Although hypolimnetic concentration in 1976 was lowered, the reduced net internal P loading continued at a significant rate suggesting the littoral as an internal source. Epilimnotic P was also lowered, and a reduction of symptoms was indicated by a Trophic State Index, but WTL remained eutropic in 1976. It is suggested that hypolimnetic applications of alum may be more effective in large lakes

where seiches and vertical entrainment of hypolimnetic P are more significant. Details for dose determination and application are provided in the appendix. (Davison-IPA)
W79-06950

PBI REVERSE OSMOSIS MEMBRANE FOR CHROMIUM PLATING RINSE WATER,
Celanese Research Co., Summit, NJ.
H. J. Davis, F. S. Model, and J. R. Leal.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-280 944, Price codes: A03 in paper copy, A01 in microfiche. Report No. EPA-600/2-78-040, March 1978. 36 p, 3 fig, 11 tab, 7 ref. R-803620.

Descriptors: *Waste water treatment, *Reverse osmosis, *Industrial wastes, *Polymers, Membranes, Fabrication, Heat treatment, Testing, Analytical techniques, Chromium, Polybenzimidazole.

Laboratory research wherein the attempt to develop a high temperature, oxidation-resistant reverse osmosis (RO) membrane of polybenzimidazole (PBI) for use in treating metal finishing effluents is reported. The effects of important casting variables and subsequent heat treatment on membrane RO properties were investigated. Membranes were tested on a high pressure circulating flow system in flat film test cells; screening was done by pretesting with a 5,000 ppm sodium chloride feed solution. A simulated rinse water containing chromic acid or plating bath solution was used to test membranes with optimum properties. PBI RO membranes were resistant to chromic acid attack. These same membranes exhibited high salt rejections when they were retested with sodium chloride which demonstrated that they had not been chemically attacked by chromic acid. Membranes pretreated with 5,000 ppm sodium tungstate tolution achieved significant improvement in long-term rejection of chromic acid; this was further improved by the continuous addition of sodium tungstate to the feed solution. Use of this approach to long-term high level rejection of chromic acid is an unacceptable practice due to the possible contamination of the plating bath by tungstate ions. Although membrane performance was improved by membrane treatment and feed pH adjustment, the project failed to develop an acceptable membrane to treat chromium plating rinse water. (Davison-IPA)
W79-06951

ANALYSIS OF OPERATIONS AND MAINTENANCE COSTS FOR MUNICIPAL WASTEWATER TREATMENT SYSTEMS,
Available from the National Technical Information Service, Springfield, VA 22161 as PB-283 471, Price codes: A13 in paper copy, A01 in microfiche. Report EPA 430/9-77-015, 1978. 232 p, 48 tab, 2 ref, 7 append.

Descriptors: *Municipal wastes, *Waste water treatment, *Cost analysis, *Cost comparisons, *Performance, Personnel, Operating costs, Maintenance costs, Efficiencies.

The operation and maintenance costs of municipal waste water treatment plants and collection systems were surveyed and analyzed. Costs are presented for different levels of waste water treatment, types of plants and collection systems, and segregated cost categories. Analyses are presented on relative costs for certain treatment variables and characteristics. Cost data utilized ranged from fourth quarter 1972 to first quarter 1977. Costs are adjusted to third quarter 1977 dollars. Only treatment plants of 1.0 mgd capacity or larger were sampled. A computer statistical package was used in the analysis. For all types of treatment levels, personnel, power, and chemical expenditures accounted for approximately 80% of total operating costs. Operating efficiency analyses indicated that the larger the plant, the lower the operation and maintenance costs per million gallons treated. Also, the more sophistoicated the treatment process, the more costly waste is to treat. The total operating costs are highest for sanitary sewer systems and lowest for mixed systems which have sanitary sewers plus storm sewer systems. (Small-FRC)
W79-06955

TRACE ORGANIC VARIATION ACROSS THE WASTEWATER TREATMENT SYSTEM OF A CLASS-B REFINERY,
Argonne National Lab., IL. Energy and Environmental Systems Div.
L. A. Raphaelian, and W. Harrison.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-285 596, Price codes: A09 in paper copy, A01 in microfiche. Report EPA-600/7-78-125, 1978. 183 p, 7 fig, 19 tab, 6 ref, 5 append.

Descriptors: *Pilot plants, *Activated carbon, *Activated sludge, *Industrial wastes, *Oil industry, Performance, Organic compounds, Filtration, Waste water treatment.

The efficiency of a pilot-scale granular activated carbon sludge treatment system of a Class B petroleum refinery that met BPT in 1977, was evaluated. Effluents at SOHTO's Toledo refinery from the full-scale system (dissolved-air-flotation unit and final clarifier for the activated-sludge unit) and an add-on pilot scale unit (mixed media filter and activated carbon columns) were sampled for analysis of common waste water parameters and trace organic compounds. Four-day composites of daily samples were analyzed using capillary-column gas chromatography/mass spectrometry. The activated sludge unit removed aromatic compounds better than it did nonaromatics while the activated carbon unit was better at removal of nonaromatics. Average percentage removal of organics present in the DAF effluent was more than 99% for activated sludge, about 0% for mixed-media filter, and less than 1% for activated carbon. Eighty-one percent of the less than 1% of trace organics remaining in the final-clarifier effluent were removed by the activated carbon. These removal estimates are only approximate. (Small-FRC)
W79-06956

TREATMENT OF PACKINGHOUSE WASTEWATER BY INTERMITTENT SAND FILTRATION,
East Central Oklahoma State Univ., Ada.
M. L. Rowe.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-289 768, Price codes: A04 in paper copy, A01 in microfiche. Report EPA-600/2-78-205, 1978. 71 p, 13 fig, 30 tab, 25 ref, 1 append.

Descriptors: *Filtration, *Waste water treatment, *Food processing industry, *Aerated lagoons, *Standards, Biochemical oxygen demand, Suspended solids, Coliforms, Ammonia, Oil.

The use of intermittent sand filters as a means of upgrading waste treatment systems for small packing houses was evaluated. The treatment system examined consisted of an extended aeration lagoon in series with an intermittent sand filter. A filter run of 109 days was observed with a hydraulic loading rate of 0.36 mgd and a sand source having an effective diameter of 0.35 mm and a uniformity coefficient of 2.5. The average BOD was 10.4 mg/liter and the average TSS was 11.1 mg/liter. When the 1983 BAT limitations were considered, the effluent met the maximum day limit for TSS but the 30-day average value for TSS was exceeded. The effluent met the limits for fats, oils, grease, and pH. The NH3-N in the effluent from the treatment system met the BAT limits which were recinded by the court. The fecal coliform limits were also exceeded. It was also determined that the small packinghouse managers should use a commercial laboratory when monthly or quaterly analyses are specified. (Small-FRC)
W79-06957

REMOVAL OF HEAVY METALS FROM INDUSTRIAL WASTEWATERS USING INSOLUBLE STARCH XANTHATE,
Science and Education Administration, Peoria, IL. Northern Regional Research Center.
R. E. Wing, L. L. Navickis, B. K. Jasberg, and W. E. Rayford.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-283 792, Price codes: A06 in paper copy, A01 in microfiche. Report EPA-600/2-78-085, 1978. 116 p, 20 fig, 55 tab, 69 ref.

Descriptors: *Polyelectrolytes, *Chemical precipitation, *Heavy metals, *Separation techniques, Copper, Ammonia, Sodium, Magnesium, Absorption, Ions, Sludge, Waste water treatment, Industrial wastes.

Insoluble starch xanthate (ISX) was found effective in bench-scale tests in the removal of heavy metal ions from several industrial effluent streams. ISX was applicable over the pH range of 3-11, in the presence of salt concentrations of 0-10%, and in batch or continuous flow systems. In the bench-scale tests, ISX in combination with alum reduced residual copper to less than 0.02 mg/liter without filtration in brass mill effluent. In lead battery waste water, residual lead decreased to less than 0.05 mg/liter with ISX treatment. The material also effectively removed copper ammonia complexes in circuit board copper etchant rinse waters. The ISX-metal sludge readily settles, dewaters to about 25-50% solids with filtration or centrifugation, and the ISX adds only sodium and magnesium ions to the treated water. Treatment processes were developed for removing copper from electroless copper plating and copper pyrophosphate electroplating rinse waters utilizing ISX. (Lisk-FRC)
W79-06964

CHARACTERIZATION OF REUSABLE MUNICIPAL WASTEWATER EFFLUENTS AND CONCENTRATION OF ORGANIC CONSTITUENTS,
Gulf South Research Inst., New Orleans, LA.
J. K. Smith, A. J. Englande, M. M. McKown, and S. C. Lynch.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-280 547, Price codes: A07 in paper copy, A01 in microfiche. Report EPA-600/2-78-016, 1978. 143 p, 18 fig, 53 tab, 10 ref, 1 append.

Descriptors: *Tertiary treatment, *Performance, *Water quality, *Standards, *Municipal wastes, Reverse osmosis, Ammonia, Nitrate, Phenols, Odor, Turbidity, Heavy metals, Potable water, Public health.

Organic concentrates were collected from operating advanced waste water treatment plants for use in health effects testing. After reverse osmosis, the organics were further concentrated and then recovered by liquid/liquid extraction. Also, chemical, physical, and biological analyses were conducted of effluent to determine how the quality of the effluents compared with drinking water criteria. All advanced treatment plants tested were characterized by high quality effluents. Spot samples taken over a six to nine month period at six plants determined that nitrogen (ammonia and nitrate), phenol, odor, carbon chloroform extract, turbidity, and specific heavy metals exceeded drinking water standards in most cases. The plants tested were: Lake Tahoe, California; Blue Plains, District of Columbia; Pomona, California; Dallas, Texas; Escondido, California; and Orange County, California. (Small-FRC)
W79-06966

IMPROVED TREATMENT OF LIME-SULFIDE TANNERY UNHAIRING WASTE.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-271 616, Price codes: A02 in paper copy, A01 in microfiche. Report 1977. 8 p, 2 tab.

Descriptors: *Waste treatment, *Tannery wastes, *Flocculation, *Hydrogen sulfide, *Flash distillation, Separation techniques, Industrial wastes.

Advancements in the treatment of lime-sulfide unhairing wastes from both salt-cured and unsalted hides are discussed. Undissolved lime is flocculated out of the waste of salt-cured hide, and the supernatant is acidified to liberate hydrogen sulfide. Hydrogen sulfide is flashed off under reduced pressure at about 100 to 150F. Waste from unsalted hides is sparged with carbon dioxide before flocculation, the sparged waste is flocculated with a strongly cationic polyelectrolyte, and the hydrogen sulfide flashed off from the acidified supernatant liquid. (Small-FRC)
W79-06967

PERFORMANCE EVALUATION OF AN EXISTING SEVEN CELL LAGOON SYSTEM,
Utah Water Research Lab., Logan.
J. H. Reynolds, R. E. Swiss, C. A. Macko, and E. J. Middlebrooks.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-273 533, Price codes: A08 in paper copy, A01 in microfiche. Report EPA-600/2-77-086, 1977. 185 p, 29 fig, 49 tab, 46 ref, 5 append.

Descriptors: *Oxidation lagoons, *Sewage lagoons, *Performance, *Standards, *Biochemical oxygen demand, Coliforms, Suspended solids, Monitoring, Utah, Design criteria, Design standards, Waste water treatment, Sampling, Municipal wastes.

The performance of a seven cell faculative waste stabilization lagoon system treating waste water from a population of 471 persons was evaluated and compared with federal and Utah effluent discharge standards. Sampling of the lagoon systems consisted of: 24-hr composite raw influent samples; individual pond effluent samples collected twice a week for 13 months; and seasonal collections for 30 consecutive day periods during the same 13 month period. Samples were analyzed for BOD, soluble BOD, suspended solids, volatile suspended solids, CODm soluble COD, alkalinity, ammonia-, nitrate-, nitrite-, and total Kjeldahl-nitrogen, total phosphorus, and total algae count. Temperature, pH, dissolved oxygen, fecal coliforms, fecal streptococci, total coliform bacteria, daily influent and effluent flowrates, air temperature, wind, evaporation, and solar radiation were also monitored. The resulting data indicated that the federal discharge standard of 30.0 mg BOD/liter was met during the study but that 85% BOD removal was not attained in 4 of the 13 months studied. In 8 of the months, effluent met the 10.0 mg/liter BOD and 10.0 mg/liter suspended solids Utah standard. Effluent contained less than 30 mg/liter suspended solids 10 of the 13 months but failed to meet the federal requirement of 85% suspended solids removal 5 of the 13 months. State and federal fecal coliform levels were consistently met. Loading on the lagoon system exceeded the design criteria and design equations were not adequate for predicting overall performance. (Lisk-FRC)
W79-06968

AN AGRO-POWER-WASTE WATER COMPLEX FOR LAND DISPOSAL OF WASTE HEAT AND WASTE WATER,
Pennsylvania State Univ., University Park. Inst. for Research on Land and Water Resources.
D. R. DeWalle.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-239 675, Price codes: A10 in paper copy, A01 in microfiche. Report, 1974. 209 p, 49 fig, 49 tab, 55 ref, 1 append.

Descriptors: *Ultimate disposal, *Application methods, *Sprinkler irrigation, *Thermal pollution, *Nuclear power plants, Return flow, Land management, Agriculture, Land use, Water cooling, Soil temperature, Soil moisture, Prototypes, Model studies, Equations, Waste water treatment, Municipal wastes.

A 0.23 acre field prototype of an Agro-Power-Waste Water complex was utilized to evaluate the feasibility of waste heat and water disposal on agricultural land. Municipal waste water was applied to the land by sprinkler irrigation and maintained a high soil moisture content and thermal conductivity. Waste heat from power production was dissipated by circulating hot water through a pipe network imbedded in the land. Soil temperature, soil thermal conductivity, heat dissipation, degree of waste water treatment, soil surface temperature, and climatic conditions were monitored on the site. Test equations were developed from the data for predicting heat dissipation and surface temperature for use in a system analysis. Results of the analysis indicated that a 1,500 MWe nuclear electric plant would require 4,500 acres of land equipped with 2-inch diameter piping at a depth of 1 ft and spaced 2 ft apart in sandy soil. A nuclear fuel penalty concept was incorporated into a comparison of this system with conventional waste heat disposal systems. A cost analysis of the land disposal system indicated that it was less expensive than dry-cooling towers but more expensive than wet-cooling towers. (Lisk-FRC)
W79-06969

TECHNICAL ASSISTANCE PROJECT, TRINIDAD WASTEWATER TREATMENT FACILITY, TRINIDAD, COLORADO.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-256 451, Price codes: A03 in paper copy, A01 in microfiche. Report, 1972. 39 p, 2 tab, 2 fig, 7 ref.

Descriptors: *Municipal wastes, *Aerobic treatment, *Operations, *Aeration, *Performance, Oxygen requirements, Waste water treatment, Management, Oxygen.

Operation of the Trinidad waste water treatment facility was evaluated; recommendations concerning plant limitations were made. Major limitations were the lack of an adequate oxygen supply to the aeration basins and aerobic digester, and lack of adequate aerobic digester sludge detention time. The quantity of oxygen supplied was determined to be only half of that required for optimum performance of the aeration basins and aerobic digester. The aerobic digester was determined to be only one-third of the required size at the present plant flow of 1 mgd. Other limitations are described. Recommendations include reconstruction or alteration of the influent channel to provide operators with a dry work area for repairs, a minimum of 70 mg/liter/hr of oxygen be supplied to the mixed liquor in the aeration basins and to the sludge in the aerobic digester, and the minimum detention time in the aerobic digester should be 25 days. (Small-FRC)
W79-06970

LAND TREATMENT OF WASTEWATER IN SOUTHEASTERN MICHIGAN,
Michigan State Univ., East Lansing. Dept. of Crop and Soil Sciences.
B. G. Ellis, A. E. Erickson, B. D. Knezek, R. J. Kunz, and I. F. Schneider.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A041 125, Price codes: A09 in paper copy, A01 in microfiche. Report 1973. 226 p, 1 fig, 81 tab, 16 ref.

Descriptors: *Municipal wastes, *Waste water treatment, *Irrigable land, *Land use, *Application methods, Drainage, Percolation, Soils, Crops.

Data were assembled and interpreted in order to develop irrigation zones for waste water utilization by land application as an alternative effluent treatment method for Detroit. The principal crops that can be grown under irrigation include corn, navy and soybeans, wheat, alfalfa-brome hay, and to a lesser extent, sugar beets. Problems which may be encountered include percolation rate problems and drainage problems in fine-textured soils. For problem soils, 12.5 inches of water per acre is the maximum that can be applied. This application would be scheduled to offset the moisture deficit during the summer months. Application rates on sandy soils will be limited by phosphorus adsorbing capacity. If the phosphorus content is 7 ppm, the application rate sould be limited to 40 inches per year. The total application of water in the 25 counties of Southeastern Michigan is approximately 68 million acre inches per year. More than one-third of the potentially available area would have to be developed to treat Detroit area waste water. (Small-FRC)
W79-06971

EFFECTS OF FLOW EQUALIZATION ON THE OPERATION AND PERFORMANCE OF AN ACTIVATED SLUDGE PLANT,
Ypsilanti Township, MI.
G. W. Foess, J. G. Meenahan, and D. Blough.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-272 657, Price codes: A06 in paper copy, A01 in microfiche. Report EPA-600/2-77-138, 1977. 95 p, 8 fig, 17 tab, 20 ref, 1 append.

Descriptors: *Pilot plants, *Activated sludge, *Flow characteristics, *Performance, *Costs, Biochemical oxygen demand, Suspended solids, Municipal wastes, Waste water treatment, Nitrogen, Phosphorus, Capital costs.

A pilot plant program evaluated the impact of flow equalization on the 14,000 cu m/day (3.7 mgd) upgraded activated sludge plant of Ypsilanti Township. Process streams were characterized under equalized and unequalized flow conditions with respect to BOD, COD, TSS, and forms of nitrogen and phosphorus. The equalization system functioned in a reliable manner throughout the study and was highly effective in leveling influent diurnal flow variations and providing a uniform daily flow rate to the activated sludge process. Reduction in the variances of BOD, TSS, COD, SOP, TP, and NH3-N across the equalization basin were in the range of about 20 to 80% based on concentration and 45 to 95% based on mass. Some biochemical action occurred in the basin, and there was an increase in suspended solids. BOD removal was marginal and inconsistent. Analysis of secondary effluent indicated that the effects of flow equalization were less important in determining effluent quality than the effects of other operational variables including organic loading intensity, sludge settleability, wind and density currents, recycle rate, sludge blanket height, chemical dose, etc. A cost analysis indicated that the capital costs associated with conversion of existing digesters to equalization basins were about 25% of new construction costs. No power cost economies occurred with flow equalization. (Small-FRC)
W79-06972

TREATMENT AND DISPOSAL OF WASTES PUMPED FROM SEPTIC TANKS,
Storrs Agricultural Experiment Station, CT.
J. J. Kolega, A. W. Dewey, B. J. Cosenza, and R. L. Leonard.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-272 656, Price codes: A06 in paper copy, A01 in microfiche. Report EPA-600/2-77-198, 1977. 151 p, 57 fig, 24 tab, 41 ref, 9 append.

Descriptors: *Septic tanks, *Waste disposal, *Anaerobic digestion, *Aerobic treatment, *Land use, Performance, Biochemical oxygen demand, Chemical oxygen demand, Nitrogen, Laboratory tests, Pilot plants, Biological treatment, Costs.

Two approaches for treating and disposing of septage were developed and tested in laboratory and pilot plant studies: soil injection and anaerobic-aerobic series processes. These processes can sustain shock loadings and reduce concentrations of BOD, COD, and total Kjeldahl nitrogen by at least 93%. Most of the nitrogen is converted to nitrate. The combined treatment of septage and sewage in a conventional biological treatment plant was considered. The total cost of treating 1000 gal (3785 liters) of septage is about 18 times the cost for treating the same amount of raw waste water in a secondary treatment facility. Operating costs for treating septage in 10 mgd plants are about half the treatment costs in 1 mgd plants or at 1972 prices: $1.80/1000 gal ($0.48/1000 liters) as compared with $3.24/1000 gal ($0.86/1000 liters). (Small-FRC)
W79-06974

EVALUATION OF EXISTING SYSTEMS FOR LAND TREATMENT OF WASTEWATER AT MANTECA, CALIFORNIA, AND QUINCY, WASHINGTON,
Army Terrestrial Sciences Center, Hanover, NH.
I. K. Iskandar, R. P. Murrmann, and D. C. Leggett.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A045 126, Price codes: A04 in paper copy, A01 in microfiche. Report 1977. 34 p, 8 fig, 6 tab, 20 ref, 2 append.

Descriptors: *Waste water treatment, *Ultimate disposal, *Municipal wastes, *Land management, *Evaluation, Application methods, Leachate, Soil chemistry, Phosphorus, Nitrates, Nitrogen, Organic matter, Groundwater, Water quality.

Waste water disposal sites at Manteca, California, and Quincy, Washington, were evaluated for current performance and for the long-term impact of waste water application. These sites have been operated as slow-infiltration, land-disposal systems for up to 20 years. Water quality was used to evaluate current performance, and soil chemical parameters were measured to determine the effects of prolonged waste water application. Differences in pretreatment did not affect current performance. Differences in the performance of the two sites were due primarily to management practices, site history, and climatic differences. Leaching of nitrate was observed at both sites, but the impact on groundwater quality was within acceptable limits (<10 mg/liter of N03-N). Leaching of phosphorus was at both sites to a depth of 150 cm, but it was higher at Manteca. The higher level was due to crop management, land use, and mode and schedule of waste water applications. Total and extractable phosphorus increased in the surface soil levels with time. Soil nitrogen, on the other hand, appeared to decrease, probably due to mineralization. Soil organic matter and cation exchange capacity increased. There was an increase in exchangeable Na, but not enough to produce alkaline or saline conditions. A drop in soil pH after prolonged application was probably due to the removal of carbonates by leaching and by H(+1) from nitrification. Leachate quality, with proper management, should meet proposed EPA guidelines for drinking water. (Small-FRC)
W79-06975

TOC, ATP AND RESPIRATION RATE AS CONTROL PARAMETERS FOR THE ACTIVATED SLUDGE PROCESS,
Hillsboro Sewage Treatment Plant, OR.
C. Ortman, T. Laib, and C. S. Zickefoose.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-272 615, Price codes: A04 in paper copy, A01 in microfiche. Report EPA-600/2-77-142, 1977. 60 p, 13 fig, 14 tab, 7 ref.

Descriptors: *Industrial wastes, *Activated sludge, *Respiration, *Aeration, *Oxygen demand, Carbon, Organic matter, Operations, Waste water treatment, Computer programs.

The feasibility of using TOC (Total Organic Carbon), ATP (Adenosine Triphosphate), and respiration rates as tools for controlling a complete mix activated sludge plant handling a significant amount of industrial waste, was investigated. A modified F/M ratio was the basis of the control methodology. This ratio was determined by calculating aerator organic loading based on waste water TOC concentration and microorganism concentration and/or activity by TOC and ATP of the activated sludge. Process control decisions were based on 5 to 7 determinations/day. The need for increased or decreased sludge aeration time was determined by respiration rates. Regulatory permit requirements were met when respiration rates were held between 8 to 20 mg O2/gm/hr and other parameters were in an optimum range. A programmable calculator was used to aid in process decisions. Operators could input plant data and instructions for process settings were generated. Functional programs included return rates, mode changes, wasting rates, respiration rate, and corrected settlometer volume. (Small-FRC)
W79-06976

FIELD PROTYPE DEMONSTRATION OF THE SWIRL DEGRITTER,
American Public Works Association, Chicago, IL.
R. H. Sullivan, J. E. Ure, and P. Zielinski.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-272 668, Price codes: A05 in paper copy, A01 in microfiche. Report EPA-60012-77-185, 1977. 64 p, 32 fig, 29 tab, 4 ref, 1 append.

Descriptors: *Waste water treatment, *Separation techniques, *Suspended solids, *Evaluation, *Centrifugation, Costs, Maintenance, Domestic wastes, Storm runoff, Urban runoff.

A 1.8 m diameter swirl degritter designed for a flow of 65.6 liter/sec (1.5 mgd) was evaluated. When tested with sanitary domestic waste water, the swirl unit performed at slightly less efficiency than the conventional aerated grit unit which was operating at less than twice the normal flow-through rate. The characteristics of the grit removal from the swirl degritter were excellent; particles of 0.2 mm diameter were removed. Three Chasick sampling units analyzed grit removal. When blasting sand was added to provide extremely high concentrations of 0.2 mm particles, the unit efficiently removed the particles. The degritter could be used for domestic waste water, combined sewer overflows, or urban stormwater runoff treatment. The lack of moving parts in the basic unit and the unit's small size make it attractive for many applications. An analysis of construction, operating, and maintenance costs for a twenty year life indicated that the swirl degritter is 26 to 38% less costly than the conventional aerated grit chamber. (Small-FRC)
W79-06977

DEVELOPMENT EFFORT TO DESIGN AND DESCRIBE PINK WATER ABATEMENT PROCESSES,
Westgate Research Corp., Los Angeles, CA.
F. C. Farrell, J. D. Zeff, T. C. Grase, and D. T. Boylan.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A045 126, Price codes: A04 in paper copy, A01 in microfiche. Report 1977. 63 p, 11 fig, 8 tab, 1 append.

Descriptors: *Industrial wastes, *Waste water treatment, *Ozone, *Ultraviolet radiation, *Pilot plants, *Performance, Design, Capital costs, Operating costs, Annual costs.

A pilot plant test program was carried out to obtain design, operating, and cost information needed to develop a 5000 gpd pilot plant for pink water abatement. A 1000 gpd ULTROX pilot plant (UV-ozone) was used. TNT in tap water equivalent in content to ARRADCOM pink water was used to establish minimum power/residence time operating conditions. Final tests were made on pink water shipped from ARRADCOM. The 5000 gpd pilot plant reactor should have a wet volume of 625 gal and will require up to 37.5 lb of ozone/day and 144, 65 watt UV lamps. There should be a maximum of six reaction stages. Preliminary design drawings have been made of the pilot plant. Overall assembly, reactor assembly, and UV wiring schematic prints are presented along with specifications on standard ozone generators. A program is presented for developing the 5000 gpd pilot plant including the costs involved. Capital costs for a 100,000 gpd ULTRX system to remove 140 ppm TNT and 70 ppm RDX from pink water effluent to <1 ppm TNT and <1 ppm RDX are estimated at $432,000. Annual operating costs are estimated at $87,5000. Total direct cost/1000 gal is $2.50. (Small-FRC)
W79-06978

AN EVALUATION OF THE ENGINEERING DESIGN PARAMETERS OF HYDROGEN PEROXIDE, ULTRAVIOLET OXIDATION OF REFRACTORIES IN WASTE WATER,
Naval Academy, Annapolis, MD.
W. A. Barr.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A045 351, Price codes: A02 in paper copy, A01 in microfiche. Report, 1976. 14 p, 5 fig, 1 tab.

Descriptors: *Industrial wastes, *Waste water treatment, *Oxidation, *Ultraviolet radiation, *Performance, Design, Reflectance, Energy, Acids.

Design data were determined for the application of ultraviolet hydrogen peroxide treatment to waste water. Tests with acetic acid indicated that the most difficult refractories in waste water can be oxidized completely with hydrogen peroxide in the presence of ultraviolet radiation. The design of the oxidizing chambers can minimize the treatment time or the energy required per unit volume of the reactants. In an investigation of the ultraviolet radiation reflectivity of the reactor chamber wall using aluminum surfaces and galvanized steel, the reflectivity did not affect the rate at which the oxidation occurred. Design data are needed on equipment to oxidize refractories other than acetic acid. (Small-FRC)
W79-06979

DES MOINES 208 AREAWIDE WASTE TREATMENT MANAGEMENT PLAN.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-272 305, Price codes: A14 in paper copy, A01 in microfiche. Report 1977. 88 p, 9 fig, 15 tab, 41 ref, 4 append.

Descriptors: *Municipal wastes,*Waste water treatment, *Sludge disposal, *Sewage treatment, *Sewerage, Combined sewers, Infiltration, Filtration, Aeration, Urban runoff, Agricultural runoff, Water quality, Land use, Environmental effects.

A plan is proposed for the Des Moines Metropolitan Area waste treatment which includes nonstructural and structural programs for the control of point, intermittent point, and nonpoint sources. Point source actions include the construction of a waste water collection system with minimum infiltration and construction of a new sewage treatment plant with an activated biofilter unit and supplemental aeration. Dewatered anarobic sludge will be applied to agricultural land or disposed at the Metropolitan landfill. Intermittent point source controls include segregation of combined sewers and the installation of flow separators at selected combined and storm sewer discharge points. Nonpoint source controls include reducing pollution from cropland runoff, construction sites, and unincorporated areas. The proposed plan will significantly improve water quality and will eliminate water quality violations under wet and dry weather conditions. Adverse impacts include fugitive dust emission, noise, disturbance of vegetation and wildlife, and disruption of land use during construction. During operation of the treatment facilities, the generation of sludge is the major adverse impact. Alternatives include alternate methods of waste water treatment, alternate sludge disposal and treatment methods, and alternate subplans for minimizing point, intermittent point, and nonpoint pollution sources. (Small-FRC)
W79-06981

ACTINOMYCETES OF SEWAGE-TREATMENT PLANTS,
Rutgers - The State Univ., Piscataway, NJ. Waksman Inst. of Microbiology.
H. A. Lechevalier, M. P. Lechevalier, and P. E. Wyszkowski.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-272 589, Price codes: A05 in paper copy, A01 in microfiche. Report EPA-600/2-77-145, 1977. 89 p, 6 fig, 15 tab, 5 ref.

Descriptors: *Actinomycetes, *Activated sludge, *Anaerobic digestion, *Foaming, *Sewage treatment, Sewage bacteria, Toxicity, Settling basins, Aeration, Foam separation.

Methods of controlling actinomycetic foaming in the secondary aeration and settling tanks of four

activated sludge sewage treatment plants were evaluated. The formation of Nocardia-rich foam in the secondary aeration tanks is considered a health hazard due to the formation of Nocardia-containing aerosols as well as a cause of reduced treatment efficiency and increased labor. The supernatant from anaerobic digesters, previously thought to contain suspended solids that were toxic to Nocardia, was not toxic for all bacteria. The study attempted to control foaming in four sewage treatment plants equipped with anaerobic digesters by returning supernatant from the digesters to the primary treatment system. Nocardia presence was determined visually and by gas chromatography detection of nocardomycolic acid in the suspended solids. The results of the studies indicated that Nocardia-infected foams should be discharged to the anaerobic digester and nocardiotoxic material should be added to the activated sludge reactor. A study of the chemical nature of the nocardiotoxic compounds was also recommended. (Lisk-FRC)
W79-06982

INDUSTRIAL PROCESS PROFILES FOR ENVIRONMENTAL USE: CHAPTER 7. ORGANIC DYES AND PIGMENTS INDUSTRY,
Radian Corp., Austin, TX.
For primary bibliographic entry see Field 5B.
W79-06985

INDUSTRIAL PROCESS PROFILES FOR ENVIRONMENTAL USE: CHAPTER 10. PLASTICS AND RESINS INDUSTRY,
Radian Corp., Austin, TX.
For primary bibliographic entry see Field 5B.
W79-06986

INDUSTRIAL PROCESS PROFILES FOR ENVIRONMENTAL USE: CHAPTER 26. TITANIUM INDUSTRY,
Radian Corp., Austin, TX.
For primary bibliographic entry see Field 5B.
W79-06987

PYROGENIC ACTIVITY OF CARBON-FILTERED WATERS,
Texas A and M Univ., College Station.
H. W. Wolf, B. J. Camp, and S. J. Hawkins.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-293 172, Price codes: A06 in paper copy, A01 in microfiche. Report EPA-600/1-79-009, 1979. 112 p, 14 fig, 20 tab, 11 ref, 4 append.

Descriptors: *Activated carbon, *Filtration, *Performance, *Waste water treatment, *Water purification, Potable water, Activated sludge, Coliforms, Microorganisms, Toxicity, Carbon, Organic matter, Correlation analysis, Public health.

The endotoxin content and pyrogenic response of granular activated carbon (GAC) filtered waters were studied. GAC-filtered secondary effluent from an activated sludge pilot plant contained free endotoxins in the range 6-250 micrograms/liter yielding positive pyrogenic responses in 18 of 20 trails. Samples were obtained from 27 different supplies that utilize GAC adsorption and were found to contain free endotoxin ranging from 1.2-25 micrograms/liter, but none gave a pyrogenic response. No relationship was found between endotoxin content and pyrogenic response. GAC beds which had been in operation in water treatment plants without regeneration for as long as 110 months, removed small amounts of total organic carbon (TOC). Of these, however, 5 of 28 samples showed an increase in TOC through GAC and 8 of 28 samples showed an increase in standard plate count. None of the 28 contained coliforms, but one of 25 yielded pseudomonads. Good correlations were observed on non-disinfected AWT effluent samples between standard plate count and total endotoxin (r=0.945), standard plate count and free endotoxin (r=0.932), and total coliforms and free endotoxin (r=0.939). Good correlations were not observed in assaying AWT samples that had been subject to the disinfecting procedures of chlorimation, ozonation, pH or UV irradiation. Thus, pyrogenicity was demonstrated for AWT effluents but not for GAC-processed drinking waters. (Small-FRC)
W79-06991

ELECTRODIALYSIS FOR CLOSED LOOP CONTROL OF CYANIDE RINSE WATERS,
International Hydronics Corp., Princeton, NJ.
G. W. Bodamer.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-272 688, Price codes: A03 in paper copy, A01 in microfiche. Report EPA-600/2-77-161, 1977. 34 p, 5 fig, 10 tab.

Descriptors: *Industrial wastes, *Electrodialysis, *Metallurgy, *Recycling, *Performance, Salts, Anions, Waste water treatment.

Full-scale trails were conducted of electrodialysis of brass plating rinse solutions. The system was designed to deplete dissolved salts in the rinse waters, yielding water suitable for re-cycle to the rinsing operations and returning the salts to the plating bath. Zero discharge would be achieved. The system was only about one-fourth as effective as had been expected. Earlier work successfully used electrodialysis to treat sodium copper cyanide rinse water. The inefficiency appeared to be due to a reduction in perm-selectivity of the anion membranes as a result of retention of an insoluble zinc compound or of a tightly absorbed zinc complex anion. No remedy could be found for the situation which did not affect the chemistry of the plating bath. Small-scale, preliminary tests are recommended for future applications of this promising technique. (Small-FRC)
W79-06993

FULL-SCALE OPERATION OF A SINGLE-STAGE NITRIFICATION-DENITRIFICATION PLANT,
Owego Town, NY.
D. E. Schwinn, D. F. Storrier, and D. G. Thorne.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-272 728, Price codes: A05 in paper copy, A01 in microfiche. Report EPA-600/2-77-088, 1977. 73 p, 14 fig, 13 tab, 12 ref.

Descriptors: *Municipal wastes, *Waste water treatment, *Nitrification, *Denitrification, *Performance, Design, On-site testing, Aeration, Biochemical oxygen demand, Suspended solids, Costs.

A single-stage nitrification-denitrification process was operated full-scale to determine process feasibility and reliability, necessary design features, and operating techniques to ensure optimum performance. The test plant was selected because waste water temperatures ranged from 8 to 22C, and nitrification-denitrification can be difficult to operate under extremely cold waste water temperatures. Alternating aerobic-anoxic conditions were achieved in completely mixed reactors by the on-off cycling of mechanical aerators. Nitrogen removals from 76 to 86% were accomplished with hydraulic retention times of 13 to 27 hr. BOD and suspended solids reductions were above 90%. Nitrogen removal was reduced to 67% for a 2-3 week period in the summer because of excessive solids inventory but was restored by reducing solids inventory. Thus, nitrogen removal can be achieved in many existing plants at little or no capital cost by implementing single-stage nitrification-denitrification if the design conditions and waste water characteristics are favorable. (Small-FRC)
W79-06994

PRETREATMENT AND SUBSTRATE EVALUATION FOR THE ENZYMATIC HYDROLYSIS OF CELLULOSIC WASTES,
Army Natick Research and Development Command, MA. Food Sciences Lab.
L. A. Spano, T. H. Tassinari, C. F. Macy, and E. D. Black.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-272 104, Price codes: A04 in paper copy, A01 in microfiche. Report EPA-600/7-77-038, 1977. 41 p, 11 fig, 6 tab, 64 ref, 2 append.

Descriptors: *Pulp and paper industry, Industrial wastes, *Sludge treatment, *Cellulose, *Performance, Wood wastes, *Hydrolysis, *Enzymes, Ammonia, Laboratory tests, Solid wastes.

The applicability of various treatment methods and existing cellulosic wastes to a process for the conversion of cellulose to glucose and other reducing sugars, was investigated. Pulp and paper mill primary sludge waste was evaluated, and the following four pretreatments were investigated: modified hydropulping, two-roll milling, attritor milling, and anhydrous liquid ammonia. Attritor milling significantly increased the susceptibility of newspaper, cotton, and wood chips was effective in enhancing susceptibility to enzymatic hydrolysis. This was accomplished using 3, 6, and 10 inch diameter mills. Data indicate that large-scale mills using short processing times and high loadings may be possible. Anhydrous liquid ammonia treatment of cellulosic materials offers the potential of a chemical process in which the pretreating agent can be recycled. Materials originating from hardwood sources are more amenable to ammonia treatment than those from softwoods. Two-roll milling followed by treatment with anhydrous liquid ammonia is a possibility. Optimum equipment design, energy requirements, processing techniques, and other system variables require extensive investigation. (Small-FRC)
W79-06995

PLANT EVALUATION AT FISHING BRIDGE WASTEWATER TREATMENT PLANT, YELLOWSTONE NATIONAL PARK,
Environmental Protection Agency, Denver, CO. Region VIII.
O. K. Boe, and L. Malloy.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-278 177, Price codes: A03 in paper copy, A01 in microfiche. Report, 1977. 26 p, 8 fig, 3 tab.

Descriptors: *Waste water treatment, *Municipal wastes, *Personnel, *Seasonal, *Performance, Design, Training, Denitrification, Toxicity.

Operations evaluations were conducted at the Fishing Bridge waste water treatment facility, and deficiencies were noted. The plant design is described. Problems were identified with process control. Generally, the plant operators were seasonal employees, and training in plant operations was seen as necessary. Also, emphasis on detailed daily logs of operation conditions and trend charts, was stressed for future operation. There were some problems with denitrification. After additional training of personnel, the oxidation ditch effluent BOD and total suspended solids level were expected to improve. Toxic substances were to be eliminated from the sewer system. If problems continue with denitrification, surface skimmers may need to be installed on the final clarifier. (Small-FRC)
W79-06997

REMOVAL AND RECOVERY OF SULFIDE FROM TANNERY WASTEWATER,
The Blueside Co., Inc., St. Joseph, MO.
R. H. Sayers, and R. J. Langlais.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-279 872, Price codes: A07 in paper copy, A01 in microfiche. Report EPA-600/2-77-031, 1977. 129 p, 18 fig, 29 tab, 20 append. 4 append.

Descriptors: *Tannery wastes, *Sulfides, *Adsorption, *Costs, *Recycling, Acids, Hydrogen ion concentration, Coagulation, Proteins, Settling basins, Waste water treatment, Industrial wastes.

A full-scale sulfide reclamation plant was constructed to investigate the feasibility of removing and recovering the sulfides in cattlehide tannery waste water. The combined tannery effluent from the soaking, unhairing, bate, pickle, and chrome tanning wastes from the tannery producing 25,000 hides per week, was screened and clarified. The

clarified effluent was pumped continuously to a degasifier in which acidification to a pH of 5.0-5.5 was effected using sulfuric acid. The hydrogen sulfide liberated from the waste water is adsorbed in recirculating caustic soda until a desired sodium sulfide concentration was achieved. The sodium sulfide is reused in the tannery's unhairing process. Using sulfide reclamation, a savings in material and freight costs was realized of approximately $92,052 per year or $84.84 per month per 1000 hides. The acidification of the total tannery waste water also results in the coagulation of the solubilized proteins which could be removed by secondary sedimentation. This would result in a sizeable reduction of the pollution load and the related sewer surcharge. (Small-FRC)
W79-06999

EFFECT OF HAZARDOUS MATERIAL SPILLS ON BIOLOGICAL TREATMENT PROCESSES,
Environmental Quality Systems, Inc., Rockville, MD.
For primary bibliographic entry see Field 7B.
W79-07000

5E. Ultimate Disposal Of Wastes

OCEAN DISPERSAL AS AN ULTIMATE DISPOSAL METHOD,
Philadelphia Water Dept., PA. Water Pollution Control Div.
For primary bibliographic entry see Field 5C.
W79-06663

PUTTING SLUDGE TO WORK.
For primary bibliographic entry see Field 5D.
W79-06805

IMPACT OF NITRILOTRIACETIC ACID (NTA) ON AN ACTIVATED SLUDGE PLANT - A FIELD STUDY,
Department of Fisheries and Environment, Ottawa (Ontario). Wastewater Technology Centre.
N. Wei, R. Stickney, P. Crescuolo, and B. P. LeClair.
Canada-Ontario Agreement on Great Lakes Water Quality, Ontario Ministry of the Environment, Pollution Control Branch, Toronto, Ontario, Canada, Research Report No. 91, 1979, 37 p, 9 fig, 20 tab, 24 ref. 71-3-3.

Descriptors: *Nitrilotriacetic acid, *Activated sludge, *Phosphorus, *Heavy metals, Sewerage, Treatment facilities, Biochemical oxygen demand, Microorganisms, *Diurnal variation.

A field study on the effects of nitrilotriacetic acid (NTA) on activated sludge was carried out at the Waterdown Water Pollution Control Plant, from January, 1972 to April, 1973. The Waterdown Plant is a conventional activated sludge plant with a design of 1 362 cu. m. per d. The nominal wastewater flow was approximately 45% of design capacity and all homes served by the sewer system were within a mile and a half of the treatment plant. The areas investigated in the study include: degradation of NTA, effect of NTA loading on chemical treatment for phosphorus removal, NTA loading and heavy metal removal in the treatment plant, and effect of NTA loading on treatment plant operation. The NTA was added to the treatment plant in the form of Sunlight Soap (a commercial laundry detergent containing 20 wt % NTA) at two rates to approximate NTA spiking levels of 8 mg per L NTA and 16 mg per L NTA. The background NTA loading in the raw wastewater averaged 2.5 mg per L NTA. Diurnal variation studies of the NTA loading showed peak values of 12 mg per L NTA in the afternoon and minimum values of 0.1 mg per L NTA at night. The raw wastewater had an average BOD5 of 100 mg per L, a suspended solids of 150 mg per L, and a total phosphorus loading of 6.0 mg per L P. Heavy metal levels averaged 0.2 to 0.5 mg per L for zinc, aluminum and iron, and 0.01 to 0.2 mg per L for lead, nickel and copper. The treatment plant efficiency averaged 86% BOD5 and 85% suspended solids removal throughout the study. (WATDOC)
W79-06850

IMPACT OF WASTES FROM A WATER TREATMENT PLANT: EVALUATIVE PROCEDURES AND RESULTS,
Illinois State Water Survey, Urbana.
R. L. Evans, D. H. Schnepper, and T. E. Hill.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-296 040, Price codes: A03 in paper copy, A01 in microfiche. Circular 135, 1979. 39 p, 17 fig, 10 tab, 11 ref, 1 append.

Descriptors: *Water treatment, *Sludge disposal, *Illinois, *On-site investigations, Water quality, Data collections, Water sampling, Analytical techniques, Methodology, Water purification, Evaluation, Streams, Environmental effects, Waste disposal, Waste assimilative capacity, Surface waters, Water properties, Chemical properties, *Pontiac(IL), *Vermilion River(IL).

This report summarized the procedures used and the results obtained in assessing the effects on a stream in Illinois of waste discharges from a water treatment plant that employs the clarification process. The water treatment plant serving Pontiac, Illinois, is located on the bank of the Vermilion River, the source of water for treatment. About 1,000 feet downstream of the plant intake is a dam which forms a pool with a maximum water depth of about 8 feet and width of 140 feet at normal pool stage. Wastes from the plant are discharged into the pool about 120 feet downstream of the water intake. The findings were reported here in 3 sections, i.e., the water treatment plant study, chemical characteristics of the stream, and biological characteristics of the stream. There was also a concluding section. All pertinent data developed during the course of the study were included in the appendix. The experience gained during the course of this work confirms the basic principle that the waters of a stream possess the capability of assimilating waste without significant degradation in water quality for normal usage. This capability is a function of stream geometry, flow, upstream water quality, and the characteristics and magnitude of the waste load. At the sites of water plants treating surface waters in Illinois, these relationships are variable. Because of this variability, an intelligent examination at each site is necessary to permit rational decisions governing the impact of waste on water quality. This study may be useful for such examinations. (Humphreys-ISWS)
W79-06889

SEWAGE SLUDGE ENTRENCHMENT SYSTEM FOR USE BY SMALL MUNICIPALITIES,
Science and Education Administration, Beltsville, MD. Biological Waste Management and Soil Nitrogen Lab.
J. M. Walker, L. Ely, P. Hundemann, N. Frankos, and A. Kaminski.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-280 662, Price codes: A05 in paper copy, A01 in microfiche. Report No. EPA-600/2-78-018, February 1978. 82 p, 29 fig, 23 tab, 8 ref. EPA-IAG-D4-0510.

Descriptors: *Waste disposal, *Sludge disposal, *Landfills, *Ultimate disposal, *Municipal wastes, Trenches, Sludge treatment, Lime, Heavy metals, Water pollution sources, Land use, Solid wastes, Equipment, Economics, Costs.

A method was developed whereby small municipalities can economically entrench without odor or surface water runoff 3 to 48 tons/day of freshly dewatered sewage sludge containing 15 to 25% solids. The readily available, relatively inexpensive equipment included a tractor equipped with a loader and backhoe and a dump truck or concrete mixer truck; a tractor operator and a truck driver were required. Trenches dug with the backhoe were 60 cm wide, 60 cm deep and 60 cm apart. One hour was required to entrench 12 tons of dewatered sludge. The estimated cost of sludge incorporation excluding land cost but including equipment, personnel, hauling 32 km each way, drainage, monitoring and final land cultivation was less than $15/dewatered ton. For reuse of previously entrenched sites a minimal time lapse of two years is sufficient when the previously entrenched sludge has been satisfactorily dewatered. To reduce the potential for metals moving through soils and becoming available to plants, liming the sludge prior to dewatering and entrenchment is recommended. This method is not appropriate in some prime agricultural land, because of the subsoil brought to the surface and the relatively large amount of heavy metals being applied. Entrenchment is appropriate when sludges cannot be land spread; however, it is a resource-wasteful practice with the potential for polluting groundwater by nitrate nitrogen leaching. (Davison-IPA)
W79-06947

DISPOSAL OF SEWAGE SLUDGE INTO A SANITARY LANDFILL,
R. Stone.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-258 680, Price codes: A20 in paper copy, A01 in microfiche. Report EPA-S-801582, 1974. 417 p, 69 fig, 92 tab, 99 ref, 7 append.

Descriptors: *Ultimate disposal, *Municipal wastes, *Sewage sludge, *Landfills, *Performance, Pilot plants, Leachate, Absorption, Odor, Lysimeters.

The disposal of liquid sewage sludge and septic tank pumping into solid waste at a sanitary landfill was investigated in a three-year demonstration project. Benchscale laboratory studies determined the moisture-absorbing capacity of typical solid wastes. Pilot plant lysimeters were used to investigate the effects of sewage and septic tank sludges on solid waste temperature, decomposition, leachate, settlement, insects, odor, and gas characteristics. Full-scale demonstration landfill operation studies were conducted with up to 100% sludge disposal. The solid waste had sufficient ability to absorb moisture and no runoff was produced. Full-scale sludge disposal was economically feasible and produced no leachate. Benefits included increased landfill compaction, greater density, and reduced blowing litter and dust. Problems with the system included odors following raw sludge or septic tank pumpings disposal and bird foraging. (Small-FRC)
W79-06965

STRONG OXIDANT CONDITIONING OF ALLENTOWN WASTEWATER SLUDGE,
Allentown Urban Observatory, PA.
P. J. Usinowicz, and J. F. Stine.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-278 681, Price codes: A03 in paper copy, A01 in microfiche. Report UO-LCCM-ALL-010, 1977. 39 p, 1 fig, 22 tab, 14 ref, 2 append.

Descriptors: *Sludge treatment, *Dewatering, *Ozone, *Ultimate disposal, *Oxidation, Municipal wastes, Lime, Performance, Costs, Waste water treatment.

Hydrogen peroxide and ozone were evaluated as sludge conditioning agents at the Allentown Wastewater Treatment Plant using anaerobically digested sludge. Combinations of hydrogen peroxide, ferric chloride, and lime were tested. Hydrogen peroxide addition was inconsistent in increasing dewaterability, but lower doses between 200 mg/liter to 500 mg/liter were most effective in sludge dewatering improvement when sludge solids were less concentrated, around 30 g/liter. At sludge solids concentrations around 40 g/liter or more, hydrogen peroxide treatment was not effective; in some cases, it was counterproductive. Effective ozone doses were 25 mg/liter to 100 mg/liter when combined with ferric chloride and lime. Higher doses were ineffective. The use of these strong oxidants increased soluble filtrate strength; however, effective conditioning under any chemical application increased soluble filtrate strength. Both oxidants could be applied sucessfully to Al-

lentown Wastewater Treatment Plant sludge. Success, however, depends on sludge solids concentrations being low (around 30 g/liter). An economic analysis indicated that hydrogen peroxide doses were not economically competitive even when used in combinations with ferric chloride and lime. Ozone was competitive. (Small-FRC)
W79-06996

MUNICIPAL SLUDGE MANAGEMENT ENVIRONMENTAL FACTORS.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-277 622, Price codes: A08 in paper copy, A01 in microfiche. Report EPA-430/9-77-004, 1977. 149 p, 2 fig, 14 tab, 6 ref, 10 append.

Descriptors: *Sludge disposal, *Landfills, *Environmental engineering, *Land use, *Agriculture, Application methods, Incineration, Oceans, Municipal wastes, Monitoring.

Environmental factors to be considered by administrators when evaluating grant applications for construction of publicly owned treatment works are discussed. This information on sludge management options can be of use to designers, municipal engineers, and others. Land application alternatives are emphasized because no EPA guidance has been issued on this subject. The general requirements for land application of sludges are discussed including stabilization, pathogen reduction, application methods and rates, and monitoring. Additional requirements for sludge application to agricultural lands are reviewed including protection of food products and agricultural lands and monitoring requirements. Three other sludge disposal methods are discussed: sanitary landfill, incineration, and ocean disposal. (Small-FRC)
W79-06998

5F. Water Treatment and Quality Alteration

REGIONAL SEWERAGE PLANNING BY MIXED INTEGER PROGRAMMING,
North Carolina Univ. at Chapel Hill. Dept. of Environmental Sciences and Engineering.
For primary bibliographic entry see Field 6A.
W79-06542

APPARATUS FOR PURIFYING WATER,
Sachs-Systemtechnik G.m.b.H., Schweinfurt (Germany, F.R.). (Assignee).
B. Hengst.
U.S. Patent No 4,119,517, 10 p, 4 fig, 4 ref; Official Gazette of the United States Patent Office, Vol 975, No 2, p 665, October 10, 1978.

Descriptors: *Patents, *Water treatment, *Water purification, *Water pollution treatment, Electrolysis, Oxidation, Organic wastes, Potable water, Equipment, Electric equipment, Gravity flow, Portable equipment.

The primary object of this invention is to provide a self-contained purification apparatus capable of reliably destroying microorganisms in raw water, which is portable, foolproof, and automatic in its operation. The appratus described is independent of external energy sources although it may use them where available. The casing of the apparatus encloses a chamber and is formed with two orifices spaced from the chamber in opposite directions but connected to the chamber to allow gravity flow of the water from one of the orifices, through the chamber, and out of the other orifice. Two electrodes mounted in the chamber for flow of the water between them are conductively connected to an electric battery by circuitry which causes current to flow between the electrodes through the water when the water and the battery satisfy proper conditions for the functioning of the apparatus, such conditions being indicated by a sensible signal. A compartment in the casing, sealed from the electrode chamber, encloses almost all the circuitry and the battery. (Sinha-OEIS)
W79-06621

ELECTROLYTIC CELL FOR TREATMENT OF WATER,
J. Miller.
U.S. Patent No. 4,119,518, 12 p, 8 fig, 3 ref; Official Gazette of the United States Patent Office, Vol 975, no 2, p 665, October 10, 1978.

Descriptors: *Patents, *Water treatment, *Water purification, *Water pollution treatment, Disinfection, Electrolysis, Electrodes, Equipment, Cleaning.

An electrolytic cell for the treatment of water comprises a closed container with a lower inlet opening and an upper outlet opening for the water and at least two electrodes which are adapted to be connected with the positive and negative poles of a DC source. In the interior of the electrolytic cell particles are located whose density is higher than that of water and which are prevented by gratings from emerging from the electrolytic cell. The gratings are arranged in front of the lower water inlet opening and the upper water outlet opening. The openings are smaller than the diameter of the particles. The electrolytic cell particles whose density is higher than that of the water are caused to eddy by the inflowing water. Owing to impingement and friction of the individual particles on the electrodes the eddying brings about mechanical cleaning of the electrodes and improves the electrical conductivity of the water to be treated. (Sinha-OEIS)
W79-06622

WATER PURIFICATION DEVICE,
Lever Bros Co., NY. (Assignee).
B. H. Bory, and A. B. Kessler.
U.S. Patent No 4,133,754, 13 p, 4 tab, 6 ref; Official Gazette of the United States Patent Office, Vol 978, No 2, p 613, January 9, 1979.

Descriptors: *Patents, *Water treatment, *Water purification, *Water pollution treatment, Activated carbon, Inhibitors, Filtration, Domestic water, Equipment.

A device for the purification of water and methods for its use are disclosed. The device is made of a closed, porous, non-woven fabric container containing granular activated carbon as the water purification agent where the fine particles of the carbon are prevented from migrating through the container when the device is immersed in water. It was found that certain chemically unrelated substances could be dispersed or mixed in with the granular activated carbon for preventing the fines of carbon from migrating through the porous container when contacted with water. It was also discovered that these inhibitor ingredients or agents would not substantially contribute any adverse flavor of their own to the treated water. These ingredients include certain mildly inhibited amylose-containing starches, wood flour and a substantially pure aluminum lanolate referred to as 'inhibitors' or 'inhibiting agents'. (Sinha-OEIS)
W79-06631

SUBMERGED SETTLER FOR SUSPENDED SOLIDS,
E. S. Posgate.
U.S. Patent No. 4,133,761, 10 p, 7 fig, 14 ref; Official Gazette of the United States Patent Office, Vol 978, no 2, p 615-161, January 9, 1979.

Descriptors: *Patents, *Water treatment, *Water quality control, Water purification, Turbidity, Settling basins, Suspended solids.

A water treatment plant extracts water from a large open main body of water into a settling enclosure submerged in the main body of water. The settling chamber is isolated from the main body of water by an enclosure wall. Input passages admit water to the settling chamber and output passages convey water from the quiescent body of water to the water treatment plant. Water entering the settling chamber is held in a substantially quiescent state for a period of time sufficient to ensure that the turbidity of water drawn from the quiescent body is substantially constant and unaffected by turbidity conditions in the main body of water. (Sinha-OEIS)
W79-06633

AN AUTOMATIC CHLORINATION SYSTEM FOR ELIMINATING BIOLOGICAL GROWTH IN PUMPING SYSTEMS FOR AUTOMATIC INSTRUMENTATION,
Environmental Monitoring and Support Lab., Cincinnati, OH. Instrumentation Development Branch.
R. P. Lauch.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-279 081, Price codes: A03 in paper copy, A01 in microfiche. Report No. EPA-600/4-78-010, January 1978. 33 p, 6 fig, 12 tab, 5 ref, 3 append.

Descriptors: *Chlorination, *Water purification, *Automation, *Microorganisms, Water quality control, Water treatment, Water pollution sources, Dissolved oxygen, Chemical reactions, Pipelines.

An investigation was undertaken to determine whether automatic chlorination could eliminate microbial growth or slime in monitor pumping systems. Dissolved oxygen (DO) was the parameter used to determine sample change within the pumping system because it is easily and accurately measured. A decrease in DO results from microbial metabolism; therefore, it must be noted that other less conspicuous parameters may also be changing. The automatic system described periodically chlorinates the lines to remove the slime microbes. It was evaluated during warm and cold weather to determine the optimum quantity and frequency of chlorination. The results of the field tests show that automatic chlorination is effective for eliminating slime from the inner pipeline surfaces of pumping systems for automatic instrumentation. The minimum daily quantity of chlorine required to keep DO change minimal was a gaseouschlorine feed rate of 2 to 2 1/2 lbs/day. DO samples collected across the pumping system 23 hours after the chlorination cycle yielded an average DO-change of zero. The optimum chlorine concentration and frequency of chlorine addition to the system were determined during the summer months when microbial growth was at a maximum. (Davison-IPA)
W79-06789

CHARACTERIZATION OF REUSABLE MUNICIPAL WASTEWATER EFFLUENTS AND CONCENTRATION OF ORGANIC CONSTITUENTS,
Gulf South Research Inst., New Orleans, LA.
J. K. Smith, A. J. Englande, M. M. McKown, and S. C. Lynch.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-280 547, Price codes: A07 in paper copy, A01 in microfiche. Final Report No. EPA-600/2-78-016, February 1978. 142 p, 18 fig, 62 tab, 10 ref, 1 append. 68-03-2090.

Descriptors: *Effluents, *Tertiary treatment, *Public health, *Water quality, *Potable water, *Water quality standards, *Water reuse, Waste treatment, Organic compounds, Heavy metals, Ammonia, Nitrates, Phenol, Odor, Turbidity, Water analysis, Sampling, Chemical analysis, Biological properties, Physical properties, Chemical properties, Reverse osmosis.

The major objective of this project was to collect organic concentrates from Advanced Wastewater Treatment (AWT) plants to be used in health effects testing. The first stage of concentration utilized a reverse osmosis process; liquid/liquid extraction was used to further concentrate the organics. The following pilot and fully operational AWT plants were selected for evaluation because of availability and because effluent quality exceeded that of secondary treatment systems: Lake Tahoe, Pomona, Escondido, and Orange County in California; Dallas, Texas; and Blue Plains, District of Columbia. In determining how the quality of the effluents from these systems compared with current drinking water regulations, chemical, physi-

cal, and biological analyses were conducted. Although AWT systems were not designed to produce potable water, all were characterized by high quality effluents. Spot samples taken over a six to nine month period indicatd that nitrogen (ammonia and nitrate), phenol, odor, carbon chloroform extract, turbidity, and specific heavy metals in most of the treated effluents exceeded drinking water regulations. (Davison-IPA)
W79-06868

RIDDING GROUNDWATER OF HYDROGEN SULFIDE. PART 2,
Lochrane Engineering Co., Orlando, FL.
T. G. Lochrane.
Water and Sewage Works, April 1979, p 66-70. 2 fig, 9 tab, 1 ref.

Descriptors: *Groundwater, *Water treatment, *Hydrogen sulfide, *Aeration, Chlorination, Optimization, Water analysis, Water sampling.

Optimum aeration for removal of H2S from groundwater depends on how well the system parameters are known. Filtration is considered to most accurate method for determining H2S concentration. The pH level is measured with a pH probe. Two grab samples, aerated and nonaerated, were collected at specific locations to determine treatment effectiveness. Analysis of these samples showed a first-order reaction for H2S removal. Using the calculated reaction rates and contact time for each aerator, a relationship was plotted for the theoretical contact times required at different hydrogen sulfide removals. These contact times formed the basis of a cost analysis between aeration and chlorination. The combined costs at different percentages of H2S removed identified the most cost-effective removal percentage for combined aeration and chlorination treatment methods. Aerator performance can be improved by increasing agitation in the trays, increasing detention time, and adding a weak acid to lower the pH and increase the H2S gas-phase prior to aeration. (Purdin-NWWA)
W79-06870

WATERBORNE DISEASE - CURRENT THREAT,
California Univ., Berkeley. School of Public Health.
For primary bibliographic entry see Field 5C.
W79-06910

PYROGENIC ACTIVITY OF CARBON-FILTERED WATERS,
Texas A and M Univ., College Station.
For primary bibliographic entry see Field 5D.
W79-06991

5G. Water Quality Control

SHIPBOARD OILY WATER POLLUTION - A PRACTICAL GUIDE FOR THE OWNER AND DESIGNER,
For primary bibliographic entry see Field 5B.
W79-06524

PROPOSED 7 YEAR WATER SUPPLY PROGRAM, STATE OF VERMONT.
Vermont State Agency of Environmental Conservation, Montpelier. Div. of Environmental Engineering.
For primary bibliographic entry see Field 6D.
W79-06538

SOUTH COASTAL WATER QUALITY MANAGEMENT PLAN, 1975.
Massachusetts Div. of Water Pollution Control, Westborough.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-279 317, Price codes: A05 in paper copy, A01 in microfiche. Massachusetts Water Resources Commission, Westborough, Publication No. 8402-85-25-9-75-CR, September 1975. 15 fig, 9 tab, 11 ref.

Descriptors: *Regional planning, *River basins, *Resources, *Water quality standards, *Water pollution, *Water pollution abatement, *Massachusetts, *Cape Cod Bay(MA), Water quality, Biochemical oxygen demand, Fecal coliform, Storm runoff, Agricultural runoff, Nonpoint pollution, Stream/segment classification, Abatement programs, Landfills, Discharge permits, Dissolved oxygen, Hydrogen ion concentration.

The South Coastal Planning Area is located southeast of Boston, includes the towns of Kingston, Plymouth, and Plympton, and is specifically concerned with the waters of these towns which drain to Cape Cod Bay. The report describes the legal provisions in setting up a basin under PL 92-500, the existing water quality problems and standards in the south coastal basin, the abatement program, the sources of nonpoint pollution, the assessment of municipal needs, and the relationship of a water quality plan to other regional plans. The basin plan establishes constraints for waste discharges through the determinants of waste load allocations. The abatement program includes a discharge permit program which establishes effluent limitations and schedules for corrective actions. The permits issued in the south coastal area cover the period through July 1, 1977, and the requirements for these permits are presented. Inherent to the goals of the basin plan are the reclassifications of the waters of the South Coastal Basin. The process and specific recommendations are contained in the report, along with an outline of the monitoring program to determine whether these goals are being achieved. The goals of the monitoring program are: (1) to assure that permit conditions are met at all treatment facilities; (2) to assure that required abatement projects result in the desired water quality; and (3) to locate any new or unknown pollution problems in the basin. Priority water quality areas are established for the planning jurisdiction, and each area is assigned a severity ranking. An appendix presents a summary of public participation activities involved in producing the South Coastal Water Quality Management Plan. (Coan-NC)
W79-06543

NITROGEN AND PHOSPHORUS LOSSES IN RUNOFF FROM NO-TILL SOYBEANS,
Science and Education Administration, Oxford, MS. Sedimentation Lab.
L. L. McDowell, M. E. Ryan, K. C. McGregor, and J. D. Greer.
Paper No 78-2508, Presented at the 1978 Winter Meeting of the American Society of Agricultural Engineers, December 18-20, 1978, Chicago, Illinois, 8 p. 10 fig, 4 tab, 18 ref. ASAE, St. Joseph, Michigan.

Descriptors: Water pollution control, *Nitrogen, *Phosphorus, *Soil erosion, Runoff, Nutrients, Water quality control, Soybeans, Mississippi, No-till.

No-till soybeans and corn can be grown on highly erodible loessial soils in north Mississippi with reduced soil and plant nutrient losses. Soil loss in 1973 from no-till soybeans, planted directly through previous crop residues, was only 0.4 metric tons per hectare (t/ha) compared with 29 t/ha from conventional till. Total (solution plus sediment) nitrogen (N) and phosphorus (P) losses from no-till soybeans were only 4.7 and 2.8 kg/ha, respectively, compared with 46.4 and 17.6 kg/ha from conventional till. Where applicable, no-till is a best management practice for reducing potential nonpoint pollution by sediments and plant nutrients in surface runoff from agriculture. (Skogerboe-Colorado State)
W79-06552

BOOMS USED FOR OIL SLICK CONTROL,
National Water Research Inst., Burlington (Ontario).
Y. L. Lau, and J. Moir.
Journal of the Environmental Engineering Division, American Society of Civil Engineers, Vol 105, No EE2, Proceedings Paper 14530, p 369-382, April 1979. 7 fig, 2 tab, 9 ref, 2 append.

Descriptors: *Oil spills, *Water pollution control, *Laboratory tests, Oil, Oil pollution, Oil wastes, Oil-water interfaces, Currents(Water), Froude number, Hydraulics, Rivers, Harbors, Water pollution, Water quality, Barriers, Oil spill booms, Containment, Oil slicks.

Experiments were conducted to determine the conditions for no contaminant of oil by a boom, the oil-water interfacial friction coefficient, and the maximum angle which a boom can be angled to the flow to deflect an oil slick. The criterion that the densimetric Froude number has to be smaller than about 0.5 for containment was verified. In addition, a new criterion was discovered which specifies a minimum boom draught. The local value of the interfacial friction coefficient was evaluated along the slick, using measured slick profiles, and was found to decrease along the length of a slick. The friction coefficient also increased with increasing oil viscosity. Based on the experimental results, an empirical relationship was derived for the maximum angle at which a barrier could be angled to the flow to completely divert an oil slick. (Sims-ISWS)
W79-06589

ALTERATION OF HYDROGEOLOGIC CONDITIONS DURING MINING OF MINERAL DEPOSITS AND WATER-RESOURCE CONSERVATION MEASURES,
All-Union Scientific Research Inst. of Hydrogeology and Engineering Geology (USSR).
V. D. Babushkin, N. N. Van'kova, Z. P. Lebedyanskaya, N. V. Sokulina, and I. I. Plotnikov.
Water Resources, Vol. 4, No. 6, p 845-858, November-December 1977. 6 fig, 4 tab, 5 ref. Translated from Vodnye Resursy, No. 6, p 59-76, November-December 1977.

Descriptors: *Mining, *Groundwater, *Pumping, *Water pollution control, Water pollution, Water pollution sources, Mine water, Acid mine water, Recharge, Subsurface waters, Water levels, Chemicals, Water chemistry, Geology, Hydrogeology, Water resources, *USSR.

A generalization of the observations of phenomena occurring in regions of development of mining operations and exploitation of large subsurface-water intakes showed that under these conditions, complex processes occur which have been studied in various degrees. Intense water withdrawal, accompanied by a change in the conditions of recharge and discharge of subsurface waters, often leads to a change in the chemical composition of the waters being withdrawn and to depletion of the subsurface-water supply. In addition, the formation of deep and extensive cones of depression in the system of aquifers causes consolidation of the entire rock stratum and deformation of the ground surface. On the other hand, the discharge of mine waters being pumped out is often linked with pollution of subsurface waters in the region of the deposits and of waters of surface streams. Two ways of protecting water resources in mining regions were proposed. The first is based on developing criteria of the safe exploitation of subsurface-water intakes in regions of water-lowering and drainage systems at mineral deposits without the use of special protective devices. The second method is based on the use of engineering methods of water resources protection (treatment of mine water, use of the waters withdrawn by wellpoints, construction of a watertight curtain around the deposit or its individual zones). (Sims-ISWS)
W79-06615

SEPARATING DEVICE TO SEPARATE TWO LIQUIDS OF DIFFERENT SPECIFIC GRAVITY,
L. W. C. deJong.
U.S. Patent No. 4,132,651, 4 p, 2 fig, 7 ref; Official Gazette of the United States Patent Office, Vol 978, no 1, p 239, January 2, 1979.

Descriptors: *Patents, *Oil pollution, *Water pollution treatment, *Separation techniques, Water quality control, Specific gravity, Equipment, Flow.

A separating device for separating two liquids of different specific gravities such as oil and water employs a basin and a separator unit which has flow ways spaced one above the other formed of imperforate, upwardly inclined inverted V-shaped plates for the flow of the liquid of lighter specific gravity toward the apex of each plate and upwardly in the direction of the length of the plates. The inlet for the liquid mixture is adjacent the lower extremities of the plates and the outlets for the cleaned water and for the lighter liquid separated in the separator unit is at the upper extremities of the plates which are near the upper extremities of the wall of the basin. (Sinha-OEIS)
W79-06628

SLOTTED BAFFLE FOR USE IN SEPARATING OIL-WATER MIXTURES,
Chevron Research Co., San Francisco, CA. (Assignee).
D. K. Anderson, and M. A. Stewart.
U.S. Patent No. 4,132,652, 4 p, 2 fig, 5 ref; Official Gazette of the United States Patent Office, Vol 978, no 1, p 239, January 2, 1979.

Descriptors: *Patents, *Water pollution treatment, *Oil pollution, *Separation techniques, Water quality control, Flow, Equipment, Baffles.

An improved baffle section for use in an oil-water separation tank is provided. The baffle section includes a perpendicular solid portion extending from above the inlet for the oil-water mixture in the tank to a position below the inlet. The perpendicular solid portion of the baffle section is arranged substantially normal to the axis of flow of the oil-water mixture in the tank to divery the flow in a downward direction. The baffle section also includes an inclined slotted portion extending downward in the direction of flow from the lower edge of the perpendicular solid portion. There are substantially more slots in the lower part of the inclined portion than in the upper part of the inclined portion to better assist the separation process. (Sinha-OEIS)
W79-06629

SUBMERGED SETTLER FOR SUSPENDED SOLIDS,
For primary bibliographic entry see Field 5F.
W79-06633

DEVICE FOR RETRIEVING FLOATING POLLUTANTS ON SURFACE WATER,
V. A. Stupica.
U.S. Patent No. 4,133,765, 6 p, 7 fig, 6 ref; Official Gazette of the United States Patent Office, Vol 978, no 2, p 617, January 9, 1979.

Descriptors: *Patents, *Water pollution treatment, *Water quality control, *Oil spills, Oil pollution, Barriers, Floating, Skimming, Equipment, Oil recovery, Gravity flow.

Oil spill retrieval apparatus of the type employing a floating flexible barrier, has an oil reservoir tank coupled with the barrier in such manner that oil is conveyed from the barrier to the tank by gravity flow. An oil intake tube interconnecting the barrier and storage tank has an outlet coupled with the tank at an elevation below the water surface, and an opposed mouth floatingly supported on the surface of the water in flow communication with the flexible barrier. In preferred forms, the mouth is provided with a one-way gate precluding backflow of collected oil, and has an inflatible bladder permitting selective vertical adjustment of the mouth relative to the flexible barrier and tube outlet. One form of the invention contemplated the use of a buoyant skimmer in combination with the floating supported mouth to enhance oil separation in calm water operations. (Sinha-OEIS)
W79-06634

METHOD FOR LAKE RESTORATION,
Battelle Memorial Inst., Richland, WA. (Assignee).
G. W. Dawson, and B. W. Mercer.
U.S. Patent No 4,134,831, 7 p, 3 fig, 2 tab, 18 ref; Official Gazette of the United States Patent Office, Vol 978, No 3, p 982, January 16, 1979.

Descriptors: *Patents, *Water pollution treatment, *Water quality control, Water pollution sources, Mine waste, Ion exchange, Binders, Sediments, Mine tailings, Ocean mining, Lake restoration, Magnetic retrieval.

This invention overcomes the difficulties of prior art underwater mining and water body restoration proposals and provides a new and effective method of removing water-soluble substances from the rainwater run-off of mine tailing piles. The process is especially advantageous as compared to prior in situ methods because the invention can be used to remove pollutants from almost any type of aqueous environment and because such pollutants are removed permanently so they cannot possibly be rereleased to the environment at some future time. Magnetically attractable collection units containing an ion exchange or sorbent media with an affinity for a chosen target substance are distributed in the sediments or tailings. After a period of time has passed sufficient for the particles to bind up the target substances, a magnet drawn through the sediments or across the tailings retrieves the units along with the target substance. In many instances the medium can be regenerated and the units subsequently put back into use. The target substance may subsequently be refined for use or, if no commercial value, disposed of in a suitable manner. (Sinha-OEIS)
W79-06640

TROPICAL DISEASE BILHARZIA AND IRRIGATION SYSTEMS IN PUERTO RICO,
Center for Energy and Environment Research, Caparra Heights (Puerto Rico). Div. of Human Ecology.
W. R. Joblin.
Journal of the Irrigation and Drainage Division, Proceedings of the American Society of Civil Engineers, Vol. 104, No. IR3, p 307-322, September 1978. 5 fig, 8 tab, 20 ref.

Descriptors: *Irrigation, *Public health, *Puerto Rico, *Reservoirs, *Schistosomiasis, Hydroelectric power generation, Agricultural engineering, Tropics, Parasitic disease, Drainage, South Coast System, Water supply, Water quality control, Snail control, Projects.

In many tropical countries, the construction of irrigation and hydroelectric systems has caused outbreaks of the parasitic disease, bilharzia, or of schistosomiasis, which is transmitted to man from a fresh-water snail and caused by the parasitic schistosome. The history of irrigation systems in Puerto Rico shows that transmission occurred in the South Coast System soon after it went into operation. The prevalence of infection in children from Guyama, a town in the irrigated zone, was zero and rose to 25% soon after irrigation began. Other irrigation systems constructed later did not have this problem, apparently because they had better drainage systems and did not have the small night-storage ponds that served as snail habitats and transmission sites in the South Coast System. A snail control program was started in this System in 1954 and the prevalence in children dropped to zero by 1966. (Bell-Graf--Cornell)
W79-06671

PLANNING FOR WATER QUALITY: 1776 TO 1976,
Hydrocomp, Inc., Chicago, IL.
D. L. Hey, and W. H. Waggy.
Journal of the Water Resources Planning and Management Division, Proceedings of the American Society of Civil Engineers, Vol 105, No WR1, p 121-131, March 1979. 35 ref.

Descriptors: *Water pollution control, *Water quality, History, *Sewage disposal, *Sewage treatment, *Public health, Water resources, Planning, Reclamation, Natural resources.

Sewerage works appeared in America in colonial times. Boston had sewers prior to 1700 and cesspools by 1709. These facilities were designed to dispose of waste. The emphasis in national planning was on development. The natural resources were regarded as inexhaustible and the Nation's waterways were simply convenient disposal sites for the wastes generated by development. A major change in thinking about water quality occurred when the link between sewage pollution and fatal epidemics was established late in the 19th century. Regional water quality planning was initiated to protect water supplies and treat drinking water. Public health continued as the dominant theme in water quality planning until the 1960's when broader concerns about environmental quality came to the fore. Water quality planning today is concerned not only with the protection of human health, but also with the preparation and rehabilitation of aquatic ecosystems. (Bell Graf-Cornell)
W79-06685

MINIMIZING SALT IN DRAIN WATER BY IRRIGATION MANAGEMENT--DESIGN AND INITIAL RESULTS OF ARIZONA FIELD STUDIES,
Science and Education Administration, Riverside, CA. Salinity Lab.
For primary bibliographic entry see Field 3F.
W79-06700

MUD, BRINE MAY BE CLASSIFIED HAZARDOUS WASTE,
J. P. Pitts.
Drill Bit, Vol. 28, No. 4, p 23-24, April, 1979.

Descriptors: *Groundwater, *Water pollution control, *Regulations, *Drilling fluids, *Hazards, Oil industry, Brines, Mud, Oil wastes, Classification.

Proposed EPA regulations relating to ground water protection could completely shut down oil exploration of the Permian Basin if drilling muds and production brines are classified as hazardous wastes. The proposed regulations would add considerable delay, expense and paper work to drilling operations. An estimated 677,000 jobs will be in jeopardy if these regulations are approved. The oil industry will challenge the proposed regulations on a number of legalities as well as ask specific and definite exemptions of brines and drilling muds from the rules. (Purdin-NWWA)
W79-06714

ANNOTATED BIBLIOGRAPHY FOR WATER QUALITY MANAGEMENT, FIFTH EDITION.
Environmental Protection Agency, Washington, DC. Water Planning Div.
Fifth Edition April, 1978. 64 p.

Descriptors: *Bibliographies, Abstracts, *Water quality, Water quality act, Return flow, Water management(Applied), Waste water treatment.

This bibliography was prepared by U.S. Environmental Protection Agency to assist those agencies engaged in water quality management planning. The references cited have been selected for their applicability to 208 planning and for their availability. Each reference is followed by a short abstract, and whenever possible, by detailed price and ordering information. (Skogerboe-Colorado State)
W79-06715

REPORT OF COMMITTEE ON GROUND WATER SUPPLIES IN NEW ENGLAND.
Journal of the New England Water Works Association, Vol. 95, No. 1, p 36-41, March, 1979. 2 fig.

Descriptors: *Water pollution, *Water wells, *Coliforms, *Gravel packing, Maintenance, Cleaning, Peat, Chlorine, Disinfection, New England.

The scope of the Committee on Ground Water Supplies of the New England Water Works Asso-

ciation includes the following subjects: test well investigations; well construction; pumping tests; operational problems; yields, and water quality problems. A case history of poor well construction which resulted in a contaminated municipal water supply is presented. Coliform bacteria (not fecal) were found in the water soon after a routine maintenance procedure which used surging and plunging. Apparently the surging caused shallow groundwater containing coliform bacteria to flow through a crack in the well seal and down the gravel pack. In order to correct the problem, the source of contamination (a five-foot layer of peat) had to be removed. Chlorine was the injected and after two days the well was pumped to waste. The well was used for six months before it had to be taken out of service due to a recurrence of coliform. Much care and thought must be given to the construction of a gravel packed well before any mechanical or hydraulic methods of cleaning are used. (Purdin-NWWA)
W79-06735

STEADY-STATE DISSOLVED OXYGEN MODEL OF THE WILLAMETTE RIVER, OREGON,
Geological Survey, Portland, OR. Water Resources Div.
S. W. McKenzie, W. G. Hines, D. A. Rickert, and F. A. Rinella.
Available from Branch of Distribution, USGS 1200 S. Eads St. Arlington, VA 22202. Geological Survey Circular 715-J, 1979. 28 p, 15 fig, 5 tab, 16 ref.

Descriptors: *Model studies, *Dissolved oxygen, *Water pollution, *Rivers, *Low flow, Analytical techniques, Evaluation, Biochemical oxygen demand, Water quality control, Nitrification, Oxygen sag, Reaeration, Flow augmentation, Channel morphology, Water temperature, Oregon, *Willamette River, *Steady-state dissolved-oxygen model.

A steady-state dissolved-oxygen model, which is based on synoptic data collected during the summers of 1973 and 1974, has been formulated and tested for the Willamette River, Oregon. The model employs the accounting scheme of C. J. Velz in conjunction with a conceptually simple Lagrangian reference system. The model was calibrated and verified with separate data sets from the synoptic studies. Verification resulted in excellent agreement of model predictions with measured dissolved-oxygen data. Sensitivity analysis was used to examine the relative importance of the individual self-purification processes and model parameters. The verified model provides a planning and management tool for the critical summer low flow, high temperature conditions of the river. (Woodard-USGS)
W79-06818

LAND DISPOSAL OF SEWAGE SLUDGE VOLUME VI (APRIL 1, 1977 - MARCH 31, 1978)
Guelph Univ. (Ontario).
T. E. Bates, A. Haq, J. W. Ketcheson, and Y. K. Soon.
Canada-Ontario Agreement on Great Lakes Water Quality, Training and Technology Transfer Division (Water), Environmental Protection Service, Environment Canada, Ottawa, Canada; Ontario Ministry of the Environment, Pollution Control Branch, Toronto, Ontario, Canada, Research Report No. 90, 1979, 230 p, 143 tab, 1 app. 72-5-17.

Descriptors: *Sewage disposal, *Agricultural watersheds, *Soil contamination, Subsurface waters, Crops, Agricultural runoff, Nutrients, Metals, Precipitation(Atmospheric), Water analysis, Materials, Application methods.

The objective was to determine maximum rates of sewage sludge application which can be used on agricultural soil without contaminating sub-surface water with nitrate nitrogen and surface waters with elements pathogenic to humans and animals, and without reducing the yield or quality of the crops produced. This volume, which covers the period from April 1, 1977 to March 31, 1978, discusses the results from five years of field runoff studies with fall, winter and spring applied fluid sewage sludge on land cropped with grain corn. Nutrients and metals in runoff water were measured. The report also covers the fifth year of field rate and source studies with sludges resultingfrom treatment of sewage with calcium hydroxide, ferric chloride and aluminum sulphate for phosphorus removal. Oneexperiment involved surface sludge applications on a loam soil on which bromegrass was grown, and two experiments involved corn on a loam and a sandy loam. In a greenhouse experiment, six fluid sewage sludges, selected for their high metal content, were applied to a sandy loam soil. In a greenhouse experiment, six fluid sewage sludges, selected for their high metal content, were applied to a sandy loam soil. Eleven crops of ryegrass grown with sludge added before each crop. Half of the treatments received no sludge after the fifth crop. Crop growth and nutrient and metal uptake were studied. (WATDOC)
W79-06849

PHOSPHATE FERTILIZER AND SEWAGE SLUDGE USE ON AGRICULTURAL LAND - THE POTENTIAL FOR CADMIUM UPTAKE BY CROPS,
Department of Fisheries and Environment, Ottawa (Ontario). Wastewater Technology Centre.
M. D. Webber.
Technology Development Report EPS 4-WP-79-2, January 1979, 30 p, 1 fig, 7 tab, 42 ref.

Descriptors: *Phosphates, *Fertilizers, *Sewage sludge, *Land use, *Cadmium, *Heavy metals, Crops, Soil contamination.

Canadian research on cadmium in soils and crops is reviewed and the potential for cadmium uptake by crops grown on soils enriched with phosphate fertilizer and sewage sludge is considered. Evidence indicates that phosphate fertilizer is not a serious hazard to the human food chain, except possibly when cadmium accumulator crops are grown following successive heavy applications of fertilizers with high cadmium concentrations. Sewage sludge use on vegetable crop land appears hazardous because many vegetables accumulate cadmium and would contribute to its excessive buildup in the human body. The Food and Drug Administration calculates that U.S.A. citizens ingest from 70 to 90% of the World Health Organization maximum permissible level of dietary cadmium (70 micro G per person per day), and that any increase should be limited wherever possible. (WATDOC)
W79-06852

LANDFILL CELL DESIGNED FOR HAZARDOUS WASTE DISPOSAL,
Florida State Dept. of Public Works, Jacksonville. Sanitation Div.
A. J. Kinard, and F. P. Tuenge.
Public Works, Vol. 110, No. 5, p 92-94, May, 1979. 1 fig.

Descriptors: *Landfills, *Industrial wastes, *Waste disposal, Hazards, Water pollution control, Regulations, Groundwater, Water table, Dewatering, Bentonite, Leachate, Monitoring, Sampling.

Due to more stringent requirements of newly instituted rules and standards of the Florida Department of Environmental Regulation, the Jacksonville Department of Public Works designed a landfill which could safely handle disposal of special and hazardous wastes. One cell within the landfill was designated for this purpose. Because of a shallow water table, each fill area is dewatered by a system of perimeter ditches which depress the water table at least five feet below the cell floor. Surface runoff is diverted from the cell and directed into the dewatering ditch. Bentonite was used to seal the cell against possible leachate escaping into the groundwater of percolation of ground water into the cell. A 12-inch top coat of earth was applied to provide mechanical protection. When the cell is filled it will be covered with an impermeable barrier of natural clay to minimize infiltration. Monitoring of the area around the landfill was accomplished with six groundwater sampling wells and five surface water sampling points. Samples are analyzed quarterly for pH, iron, conductance, temperature, and COD. Annual tests are made for cadmium, chromium, copper, lead, total coliform, and pesticides. Samples indicate total containment of the leachate within the cell. (Purdin-NWWA)
W79-06863

RIDDING GROUNDWATER OF HYDROGEN SULFIDE. PART 2,
Lochrane Engineering Co., Orlando, FL.
For primary bibliographic entry see Field 5F.
W79-06870

THE HEALTH EFFECTS OF GROUND WATER RECHARGE: PART II,
National Water Well Association, Worthington, OH.
T. E. Gass.
Water Well Journal, Vol. 33, No. 5, p 38-39, May, 1979.

Descriptors: *Groundwater, *Public health, *Artificial recharge, *Water purification, *Waste water treatment, Sewage treatment, Disinfection, Oxidation lagoons, Biodegradation, Water spreading, Groundwater recharge, Soil disposal fields, Soil physical properties, Absorption, Adsorption, Contact time, Injection wells.

Depending on its quality, method of recharge, and intended reuse, water may undergo primary, secondary, or advanced treatment processes. Primary treatment mechanically removes solids from water. Secondary treatment removes dissolved or colloidal materials using biological systems. Advanced Wastewater Treatment (AWT) extracts heavy metals or toxic substances through physical or chemical means. After AWT, chlorine or ozone disinfection rids water of bacteria and virus still present. Storing effluent in open reservoirs is another way to destroy bacteria and viruses which may remain in treated water. Water spreading, an inexpensive and popular recharge method, uses soil systems to filter out bacteria, virus and other contaminants. Basic criteria used in selecting a recharge site include soil texture, water-transmitting capability, and effects of soil constituents on water. Most biodegradation takes place in the upper 24 to 30 inches of soil. Chemicals are further reduced through absorption by plants in the upper 4 to 5 feet of soil. Chemical adsorption removes pollutants until the soil's total adsorptive capacity is reached. Without adequate contact time for the occurrence of necessary chemical and biological reactions there will be little or no attenuation of pollutants. Contact time is reduced by coarse-textured soil, fractures, and pumping. (See also W79-06895) (Purdin-NWWA)
W79-06896

THE ORGANIC DRILLING FLUID CONTROVERSY: PART II,
For primary bibliographic entry see Field 8A.
W79-06898

CONTROLLED DEGRADATION AND/OR PROTECTION ZONES--SENSE,
Environmental Resources Management, Inc., West Chester, PA.
R. A. Landon.
Ground Water, Vol. 17, No. 2, p 159-161, March-April, 1979.

Descriptors: *Controlled degradation zones, *Degradation(Decomposition), *Aquifers, *Waste disposal, Waste assimilation capacity, Water pollution control, Groundwater, Regulation, Land use, Zoning, Attenuation, Leachate, Aquifer characteristics, Water quality, Classification.

Controlled degradation is a sound technical alternative to inflexible water pollution control regulations. Aquifers differ in characteristics and quality and this should be taken into account for more discriminative waste management practices. Numerous studies have shown that leachate can be

safely assimilated into the environment by various forms of attenuation, such as precipitation, adsorption-desorption, and dilution. Permeability, the controlling factor in leachate assimilation, should not be so low as to result in a concentrated buildup of leachate, or so rapid as to result in rapid and extensive migration of leachates. Waste disposal zoning is a concept which uses hydrogeologic factors in designating waste areas in areas of intense land use or waste aquifers in regions where natural or man-made ground water quality is already altered. There is a need for waste segregation based on a practical classification scheme. Wastes classified as truly hazardous and toxic should be disposed of safely. Land disposal operators must be properly trained and certified to avoid operational errors. The attitude of regulatory and legal personnel must become more open and flexible with regard to waste disposal and controlled degradation for select wastes. (Purdin-NWWA)
W79-06901

CONTROLLED DEGRADATION AND/OR PROTECTION ZONES--NONSENSE,
Science and Education Administration, Phoenix, AZ. Water Conservation Lab.
H. Bouwer.
Ground Water, Vol. 17, No. 2, p 162-164, March-April, 1979.

Descriptors: *Controlled degradation zones, *Irrigation effects, *Water reuse, *Waste water disposal, Protection, Groundwater, Aquifers, Water quality, Deep percolation.

'Controlled degradation' of ground water is, nevertheless, degradation. The following examples present ground water quality management alternatives to controlled degradation zones. As total dissolved salts and nitrate concentrations in irrigated lands increases the quality of ground water deteriorates. This can be reduced by more efficient irrigation practices. Another potential threat to ground water quality is land application of waste waters which is expected to increase dramatically in the near future. Renovated water may be of much better quality than the effluent water but is not as good as the native ground water due to the presence of nitrogen, metals, and trace organics. Encroachment of renovated effluent water upon native ground water can be controlled by a system of wells or drains or by pretreatment of sewage effluent before it is applied to land. Where degradation of ground water is inevitable the aquifers could then be used to receive, store, and renovate waste water. Whether an aquifer should be protected or abandoned depends on economic and environmental considerations. (Purdin-NWWA)
W79-06902

CONTROLLED DEGRADATION AND/OR PROTECTION ZONES--THE WAY IT LOOKS,
Geraghty and Miller, Inc., Port Washington, NY.
D. W. Miller.
Ground Water, Vol. 17, No. 2, p 156-158, March-April, 1979. 2 ref.

Descriptors: *Controlled degradation zones, *Water pollution control, *Aquifers, *Pollution abatement, Groundwater, Regulation, Protection, Economic feasibility, Land use, Zoning, Monitoring, Attenuation, Waste disposal, Degradation(Decomposition).

Creation of controlled degradation zones requires application of special regulatory alternatives to areas where contamination of ground water has already occurred or is expected to occur. Protection zones are areas which have not been adversely affected by pollution and have strict regulatory controls. Controlled degradation and/or protection zones are attractive because the technology of ground water pollution abatement and containment is imperfect and expensive. Controlled degradation requires a large enough buffer zone around the waste disposal site to provide some attentuation of contaminants, and adequate monitoring to provide early warning of impending problems. Where the quality of an aquifer has been extensively degraded, it is rarely technically and economically feasible to rehabilitate it to its natural state. It would be better to condemn wells penetrating the affected aquifer or treat the ground water at the well head. A uniform set of environmental controls cannot be applied as a general solution to all ground water pollution problems. It is too late and too costly to undo many past mistakes. However, with sufficient foresight and creativity, high quality aquifers can be protected with strict land-use controls and advanced engineering design. (Purdin-NWWA)
W79-06903

THE 208 PLANNING APPROACH TO GROUND WATER PROTECTION--WHAT IS WRONG AND WHAT CAN BE DONE ABOUT IT,
K. D. Schmidt.
Ground Water, Vol. 17, No. 2, p 148-153, March-April, 1979. 7 ref.

Descriptors: *Planning, *Water pollution control, *Groundwater, Administrative agencies, Regulation, Hydrogeology, Professional personnel, Education, Training.

Deficiencies in the 208 planning approach and possible remedies are discussed. These deficiencies include: overemphasis on protection of surface water quality at the expense of ground water quality; failure to recognize problems indigenous to arid lands; ambiguous definitions of 'point and nonpoint sources' of ground water pollution; inadequate specifications for the type and degree of waste treatment; a serious lack of qualified ground water geologists and hydrologists in regulatory and planning agencies; too much attention on formulating control measures and not enough on problem definition, monitoring, and data collection; lack of training in ground water quality for those ground water professionals involved in 208 programs. Solutions to these problems include placement of more ground water professionals in local, State and Federal regulatory agencies. Provisions are needed in the 208 approach to insure that ground water professionals are involved. The public should be educated on a long-term basis about ground water and pollution. Academic training in ground water needs to be expanded and ground water quality elevated to the same level as ground water quantity. Finally, registration or certification in the field of ground water hydrology is urgently needed. (Purdin-NWWA)
W79-06904

THE 208 PLANNING APPROACH TO GROUND WATER PROTECTION - A FOOT IN THE DOOR,
Illinois Environmental Protection Agency, Springfield.
D. Wallace.
Ground Water, Vol. 17, No. 2, p 142-147, March-April, 1979.

Descriptors: *Planning, *Protection, *Groundwater, *Water management(Applied), Water pollution control, State government.

As pollutants accumulate on land, the potential for ground water pollution increases, and ground water management planning becomes more significant. The 208 programs may provide the states with the means to involve the public in planning and determining practical solutions to ground water pollution problems. Needs and obstacles in establishing a 208 program for groundwater planning in Illinois are discussed. The present approach of remedial action for major cases of pollution provides a reasonable degree of protection in terms of control, but there is not a high degree of planning for the management of future ground water quality and quantity in Illinois. The 208 approach addresses three new requirements for plans prepared with Federal funding: (1) plans must have continual public involvement, (2) alternatives must include the definition of mechanisms for implementation, and (3) plans must be updated annually to reflect the results of each year's progress. Planning programs under 208 are usually regional in scope rather than site-specific. The preparation of a '5-Year Strategy' for each State under the Water Quality Management Planning programs, public involvement, and the USEPA's new emphasis on aquifer protection as a priority issue will provide the mechanism for funding ground water planning under 208 programs. (Purdin-NWWA)
W79-06905

THE 208 PLANNING APPROACH TO GROUND-WATER PROTECTION - A PROGRAM OVERVIEW,
Environmental Protection Agency, Washington, DC. Water Planning Div.
M. Hurd.
Ground Water, Vol. 17, No. 2, p 136-140, March-April, 1979.

Descriptors: *Water pollution control, *Water law, *Administrative agencies, Groundwater, Planning, Regulation, Governments, Programs, Water management(Applied).

Section 208 of the Clean Water Act will integrate economic, fiscal, social, and political factors affecting water pollution control into State and areawide plans and provide state and local governments with means to develop and enforce point, nonpoint, and ground water pollution control. 208 agencies will educate local elected officials, operating agency personnel, and the general public concerning local and regional problems and solutions. Eventually, they will play a role in the sole source aquifer designation and management process, and the siting and regulation of pits, ponds, lagoons, sanitary landfills and waste treatment facilities. Examples of successful 208 planning agencies are: Nassau-Suffolk Regional Planning Board (NY); Old Colony Planning Council (MA); and Ventura County Regional Sanitation District (CA). These agencies have used funds to identify problems such as salt-water intrusion and contamination from storm runoff. Through ground water studies, each assessed the extent of the problems and used their analysis to produce protection and control recommendations. Integration of 208 with other Clean Water Act programs as well as with programs established under the Safe Drinking Water Act and the Resource Conservation and Recovery Act are now being explored as a means of increasing water quality management efficiency and capability. (Purdin-NWWA)
W79-06906

ELECTRO-OSMOSIS IN GROUND WATER POLLUTION CONTROL,
California Univ., Santa Barbara. Dept. of Mechanical and Environmental Engineering.
J. C. Bruch, Jr.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-273 377, Price codes: A00 in paper copy, A01 in microfiche. Technical Completion Report, September, 1976. 80 p, 11 fig, 64 ref.

Descriptors: *Electro-osmosis, *Water quality control, *Groundwater movement, Finite element analysis, Aquifers, Confined water, Upconing, Seepage, Dispersion, Flow control.

A numerical model is presented to evaluate the feasibility of using electro-osmosis as a tool in ground water pollution control in aquifers of low permeability. The finite element method is applied to three types of ground water flow problems: movement of ground water in a confined aquifer; prevention of upconing during pumping; and movement of pollutants in a two-dimensional steady seepage flowfield which may have any arbitrary shape. No electro-osmosis was included in the seepage flowfield so that the seepage and dispersion could be treated as uncoupled. The electro-osmosis effect was shown to change the flowfield pattern in a confined aquifer and consequently, the movement of a pollutant in such a flowfield. The electrokinetic phenomenon also reduced the effects of water coning while pumping gas from a gas-water reservoir. (Purdin-NWWA)
W79-06913

DEVELOPMENT OF A MODIFIED TRACER TECHNIQUE FOR MEASURING THE STREAM REAERATION RATE,
Massachusetts Univ., Amherst. Dept. of Civil Engineering.
J. M. Kwasnik, and T. S. Feng.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-296 317, Price codes: A05 in paper copy, A01 in microfiche. University of Massachusetts Water Resources Research Center Publication No. 102, 1979. 68 p, 16 fig, 6 tab, 35 ref, 2 append. OWRT-A-088-MASS (1), 14-34-0001-8023.

Descriptors: *Reaeration, Rhodamine, *Tracers, *Analytical Technique, Biochemical Oxygen Demand, Chemical Oxygen Demand, Critical Flow, Dissolved Oxygen, Gas Chromotography Fluorescence, Fluorescent Dye, Ethylene.

The stream reaeration rate, K2, is a key factor in the calculation of allowable waste levels from point sources of pollution. Past attempts to produce a reliable, accurate and easy to apply method for its measurement have produced a variety of empirical equations that fail to work on river reaches significantly different from those for which the equations were developed. The modified tracer technique of K2 measurement, originally developed by Rathbun, was investigated. The technique uses a hydrocarbon tracer, ethylene, and a conservative tracer, Rhodamine-WT dye. Laboratory experiments determined the parameters essential to the successful field use of the technique. Initial field testing was begun in June, 1977 on a channelized section of the Mill River in Northampton, Mass. Two runs were conducted to verify the reproducibility and precision of the technique. Additional tests were run on the North River in Colrain, Massachusetts. The results of the field testing indicate that the modified tracer technique is a precise and accurate means of directly measuring the reaeration rate, K2. From results of preliminary laboratory experiments, it is recommended that additional laboratory testing be undertaken in regard to pollutional effects. (Godfrey-Mass)
W79-06915

6. WATER RESOURCES PLANNING

6A. Techniques Of Planning

STOCHASTIC ANALYSIS FOR WATER QUALITY,
Utah Water Research Lab., Logan.
F. Malone, S. Bowles, J. Grenney, and P. Windham.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-295 392, Price codes: A06 in paper copy, A01 in microfiche. Publication UWRL/Q-79/01, March 1979. 75 p, 10 fig, 14 tab, 2 append. OWRT A-039-UTAH (2), 14-34-0001-8047.

Descriptors: *Stochastic processes, *Linear programming, Water quality, Monte Carlo method, Phosphorus loading, Colorado River, Lake Washington.

This report demonstrates the feasibility of applying stochastic techniques to linear water quality models. The Monte Carlo, First Order, and Generation of Moment Equation techniques are applied to a long term phosphorus model of Lake Washington. The effect of uncertainty of the phosphorus loading term on simulated phosphorus levels is analyzed. All three stochastic techniques produced the same results. The simulated concentrations of phosphorus in the water column are very responsive to uncertainty in annual phosphorus loading, the sediment concentration relatively insensitive. The Monte Carlo technique requires the most computation time of the three stochastic techniques applied. The First Order and Generation of Moment Equation techniques are precise and efficient methods of stochastic analysis. In this application they required less than one thousandth the computation time of the Monte Carlo technique. The Generation of Moment Equations technique is also applied to a steady state salinity model of the Colorado River system. Two sources of uncertainty are considered: (1) the estimation of 'steady state' values of salinity loading from a limited historic data base and (2) the estimation of salinity loading from irrigated land by a semi-empirical approach. Six stochastic simulations of the Colorado River system are presented. Coefficients of variations of simulated salinities at Imperial Dam vary from 5.7 to 10.3 percent. The major source of uncertainty in all simulations is the estimation of the steady state salinity loading with the agricultural loading term becoming important in some simulated management alternatives.
W79-06501

MULTIPLE WATER SUPPLY APPROACH FOR URBAN WATER MANAGEMENT,
Weston Environmental Consultants-Designers, West Chester, PA.
A. K. Deb.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-279 768, Price codes: A07 in paper copy, A01 in microfiche. Prepared for National Science Foundation, Washington, D.C., Applied Science and Research Applications (ASRA), March 20, 1978. 118 p, 28 fig, 22 tab, 61 ref. ENV7618499.

Descriptors: *Water quality, *Water supply, *Water quality planning, *Water supply development, *Water demand, *Water management(Applied), *Models, Waste water, Drinking water, Water treatment, Water quality control, Recycling, Water distribution(Applied), Nonpotable water, Potable water.

The report describes a systems model developed to help planners and engineers to decide whether the multiple supply approach to urban water management is beneficial in long-term planning of water resources. Three grades of water were considered in developing the model: potable (from protected or unprotected sources, treated to highest quality for ingestion); subpotable (of questionable quality in terms of chemicals, but bacteriologically safe); and nonpotable (reuse of wastewater effluent for industrial, agricultural, and urban irrigation uses). Assuming that a municipal system should not employ recycled water for potable uses, separate, dual or multiple supply systems would have to be set up to provide recycled water for subpotable and nonpotable uses. Collection and analysis of water demand data included a detailed survey of water utilities serving populations of 20,000, 100,000 and 500,000 from all parts of the country. Urban water demand categories used were residential (interior and exterior), commercial, industrial, public, and unaccounted for uses. Water quality and treatment requirements for dual or multiple water supply systems, and sources of supply, are presented. The quality of potable water is regulated by the Safe Drinking Water Act of 1974 (P.L. 93-523). Cost functions of 36 unit processes were developed and incorporated into the model. The model was applied to several hypothetical single, dual and multiple water supply systems to illustrate its applicability. The model is very flexible and can handle a conventional system, a dual or multiple system including reuse, or a regional system with up to 10 cities. (Arnold-NC)
W79-06537

MARINE ECOSYSTEM MODELLING IN THE MEDITERRANEAN.
Nature and Resources, Vol 13, No 4, p 7-16, October-December, 1977.

Descriptors: *Ecosystems, *Ecology, *Mathematical models, *Marine biology, *Southern Levantine Coastal Model, *Mediterranean, Ecological distribution, Food chains, Marine microorganism's nutrients, Mathematics, Computer programming data collection, Chemical reactions, Models, Sensitivity analysis simulation.

This paper models ecological relationships and changes in the Mediterranean area. The major events causing ecological changes in the area were the opening of the Suez Canal, the construction of the Aswan High Dam, dumping of urban wastes, overfishing, and spillage of oil from tankers. The purpose of modelling is to represent nature in some abstract language as accurately and manageably as possible. This paper offers a tentative classification of appropriate models for the Mediterranean: (1) large-scale ecosystem models dealing with general relationships in the Mediterranean; (2) meso-scale and small-scale ecosystem models dealing with semi-enclosed bays and smaller marine systems; (3) process or linked-process models to describe processes such as eutrophication or toxicity; and (4) pathway models to deal with the transfer of selected metals and hydrocarbon concentrations within the main components of Mediterranean ecosystems. The principles and procedures of ecosystem modelling are outlined and the steps involved in the process are discussed. These consist of: ecosystem conceptualization; ecosystem mathematization; ecosystem calibration; ecosystem simulation; and ecosystem analysis. The Southern Levantine Coastal Model is described as an example of an ecosystem model with figures showing a generalized coastal system of the Southeastern Mediterranean. Finally data requirements for ecosystem modelling and the need for extensive research in the biological sciences to allow the modelling of problems vital to public concern are discussed. (Coan-NC)
W79-06539

REGIONAL SEWERAGE PLANNING BY MIXED INTEGER PROGRAMMING,
North Carolina Univ. at Chapel Hill. Dept. of Environmental Sciences and Engineering.
D. T. Lauria.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-281 066, Price codes: A04 in paper copy, A01 in microfiche. Sponsored by Applied Science and Research Applications, National Science Foundation, Washington, D.C., Report No. NSF-RA-E-75-203, 1975. 52 p, 6 fig, 7 tab, 3 append. GI37475.

Descriptors: *Regional planning, *Wastewater treatment, *Sewerage, *Upper Neshaminy Creek Basin(PA), *Computer models, Sewage treatment, Pumping plants, Interceptor sewers, Linear programming, Mathematics, Data processing, Cost functions, Force mains, Gravity sewers, Mixed integer programming, Computer programs.

This report presents a mixed integer programming (MIP) model for determining the location, timing, and scale of regional wastewater treatment plants, sewers, and pumping stations. There are certain economies of scale in regional wastewater treatment plants, but the problem of planning these facilities is complicated because of the large number of alternatives involved. A model was sought which would address questions of where, when, and to what scale to build regional plants, gravity sewers, pumping stations, and force mains. The model takes account of existing wastewater facilities and includes operating as well as construction costs. Concave cost equations are approximated by fixed charge functions. The solution strategy for solving the model was developed within the context of branching and bounding techniques. The strategy in this study pursued a variety of methods including disaggregation, upper bounding, priority ordering, and time staging. The model was applied to the Upper Neshaminy Creek Basin, PA, which includes 18 plant sites and 19 sewers. Pertinent data on wastewater inputs at the various nodes are presented. Solution of 9 problems is presented with between 20 and 200 integer variables, 40 to 250 continuous variables, and 60 to 450 constraints. (Coan-NC)
W79-06542

SYSTEMATIC METHODOLOGY TO NUMERICALLY EVALUATE SCENIC FACTORS OF LANDSCAPE: APPLICATION TO TIPPECANOE COUNTY, INDIANA,
Purdue Univ., Lafayette, IN. Dept. of Geosciences.
M. C. Gardner, and W. N. Melhorn.
Available from the National Technical Information

Service, Springfield, VA 22161 as PB-295 369, Price codes: A10 in paper copy, A01 in microfiche. Water Resources Research Center Purdue University Technical Report No. 110. March 1979. 195 p, 22 fig, 12 photo, 11 graphs, 2 plates, 1 append. OWRT C-6106 5213 (8).

Descriptors: *Aesthetics, *Landscaping, Scenery, *City planning, Stream valleys, Lake morphology, Lakes, Lake stages, Artificial lakes, Eutrophication, Geomorphology, Uniqueness ratio, Uniqueness index, LAND, Tippecanoe County(IND).

Fifty landscapes were delineated in Tippecanoe County, Indiana on the basis of geomorphic and cultural criteria. Measurable physical, biologic and cultural parameters which enhance or detract from landscape aesthetics were identified, described, and arranged in matrix format. Aerial photographs, topographic maps, land use maps, drainage maps and field observations were used to categorize the scenic factors in each landscape. Factor analyses of the matrices were employed to identify landscapes with unique scenic attributes. Scenic indices then were developed for the purpose of hierarchially ranking the scenic qualities of the various landscapes. Nine landscapes of unusual aesthetic value were identified in Tippecanoe County. Five of these are stream valleys whose scenic pleasantness is primarily attributable to the natural topographic diversity deriving from erosional processes and the prevalence of indigenous floral and faunal communities. The other four scenic landscapes are upland, interfluvial areas that owe their aesthetic appeal to a suite of depositional glacial features and patterns of agricultural land use. The major streams and lakes of Tippecanoe County were evaluated qualitatively and quantitatively in terms of scenic and recreational usefulness, and recommendations for their future use were proposed.
W79-06559

MODELS FOR SYSTEM WATER PLANNING WITH SPECIAL REFERENCE TO WATER REUSE,
Colorado State Univ., Fort Collins. Dept. of Civil Engineering.
D. W. Hendricks, and H. J. Morel-Seytoux.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-294 406, Price codes: A09 in paper copy, A01 in microfiche. Colorado Water Resources Institute, Colorado State University, Completion Report No. 90, June 1978. 183 p, 40 fig, 17 tab, 15 ref, 2 append. OWRT B-115-COLO (4), 14-31-0001-5060.

Descriptors: *Water reuse, *Computer models, *Mathematical models, Input-output water balance model, Optimization, Water demand, Water supply, Water resources development, Leontief models, Statistical models, Water supply development, South Platte River basin, Cache La Poudre River basin, Colorado.

Research to delineate methods for water reuse planning in the context of a complex system with the following objectives is reported: (1) to develop the matrix format for depicting a complex water system; (2) to demonstrate the application of the matrix format and its application in water planning with reference to water reuse; (3) to develop mathematical programming for a least cost objective function using non-linear cost functions. A descriptive model for an overall water system called an input-output water balance model, and a least cost computer optimization model were developed taking into account all sources of supply and all sectors of demand. Using empirical data from the South Platte River basin both models are demonstrated. Alternative modes of water development to meet overall demands in the South Platte River basin to 2020 were delineated by the input-output model. Using the Cache La Poudre as the case situation the model is also demonstrated at the subbasin level. The optimization model used the Cache La Pourde River basin for the case situation. It is concluded that both models can be used independently, or in a complimentary fashion to evaluate water reuse in its systems context. (Davison-IPA)
W79-06560

INTEGRATED WATER MANAGEMENT WITH REUSE: A PROGRAMMING APPROACH,
Arizona Univ., Tucson.
D. E. Pingry, and T. L. Shaftel.
Water Resources Research, Vol. 15, No. 1, p 8-14, February 1979. 7 fig, 3 tab, 4 equ, 13 ref.

Descriptors: *Water reuse, *Water delivery, *Economic efficiency, *Nonlinear programming, *Cost minimization, *Water quality, *Flow requirements, Water management(Applied), Equations, Design, Decision making, Optimization, Recycling, Mathematical models, Rivers, Systems analysis, Constraints, Treatment facilities, Transshipment formulation, Economies of scale.

Large quantities of high quality water may no longer be available at low cost in a growing number of regions; this has spurred interest in water reuse and recycling in the derivation of economically feasible water delivery systems increases the complexity of this optimal design problem. Presented herein is a nonlinear programming model which accounts for both flow requirements and water quality, the model containing two different constraint sets. The first set--flow constraints--can be reformulated as a transshipment form of the transportation problem where sources act as supply points (production plants) and disposal areas are demand points (markets). The objective function is to minimize total cost while meeting environmental and legal restrictions. The total cost of delivery and disposal is the sum of the piping cost, the treatment costs, the source costs and the disposal costs. Because of the model's transshipment formulation, the solution technique seems to be effective in aiding the design decisions. (Bell-Cornell)
W79-06673

TWO CENTURIES OF WATER PLANNING METHODOLOGY,
R. K. Linsley.
Journal of the Water Resources Planning and Management Division, Proceedings of the American Society of Civil Engineers, Vol. 105, No. WR1, p 39-45, March 1979. 13 ref.

Descriptors: *Water resources development, *Water plans, *Planning, *Social impact, *History, *Economic analysis, Water quality, Hydrology, Systems engineering, Environmental impact statement, Projects, Methodology.

The history of water resource planning since 1776 is reviewed with special reference to economic, social, environmental, and hydrologic methodology and applications of systems analysis. The ability of the individual planner stands out as the key factor in successful planning during the period up to about 1920. The chief of the planning team is in a similar position today. Methodology has clearly advanced during the two centuries since 1776 and is now clearly capable of providing an effective base for decision making when all aspects are properly integrated. (Bell Graf-Cornell)
W79-06679

WATER RESOURCES SYSTEMS PLANNING IN U.S.A.: 1776-1976,
Washington Univ., Seattle.
S. J. Burges.
Journal of the Water Resources Planning and Management Division, Proceedings of the American Society of Civil Engineers, Vol 105, No WR1, p 91-111, March 1979. 34 ref.

Descriptors: *Water resources, *Water plans, *Systems analysis, *Multiple-purpose projects, *History, *Systems management, Irrigation, Flood control, Water supply, Planning, Federal government, Colorado River, Canals, Waterbourne transportation, Western U.S., Agriculture.

Some historical aspects of water resources development and use covering the nation's first 200 years were examined to determine at what points in history the systems method of analysis was used in water resources planning. The systems method was found to apply to cases where clear single objectives directed planning. In situations where the systems view was not taken, less than satisfactory systems resulted. Examples considered include: canals and waterborne transportation, water supply to New York City, the Miami Conservancy District, TVA, and Irrigated Agriculture. The systems approach was followed both in the Miami Conservancy District and TVA within the limits of the analysis techniques available. Areas of potential application of systems analysis tools and techniques in the near-term future (urban water resources management, operation of multipurpose facilities, and water resource allocation) are examined to illustrate the need for the use of systems analysis tools for handling complex constrained systems. (Bell Graf-Cornell)
W79-06683

HYDROLOGY AND WATER RESOURCES PLANNING: 1776-1976,
R. K. Linsley.
Journal of the Water Resources Planning and Management Division, Proceedings of the American Society of Civil Engineers, Vol 105, No WR1, p 113-120, March 1979. 2 equ, 29 ref.

Descriptors: *Water resources development, *Hydrology, *Water plans, *History, *Hydrology, Engineering, Management, Planning.

The development of hydrology as a science and its application to planning and design of water projects is traced from the American Revolution to the bicentennial year. The factors leading to specific advances in hydrology and the mechanisms by which these advances were made are reviewed. Substantial delay between development of new techniques and their application in practice is noted. (Bell Graf-Cornell)
W79-06684

WATER RESOURCES PLANNING AND PUBLIC HEALTH: 1776-1976,
Cornell Univ., Ithaca, NY. School of Civil and Environmental Engineering.
L. B. Dworsky, and B. B. Berger.
Journal of the Water Resources Planning and Management Division, Proceedings of the American Society of Civil Engineers, Vol 105, No WR1, p 133-149, March 1979. 33 ref.

Descriptors: *Urbanization, *Water pollution control, *Water resources, *History, *Water plans, *Potable water, Water management(Applied), Water utilization, Urban development, Environmental engineering, United States, Public health.

Planning for water use and management extends from the earliest cultures of agriculture and water navigation to twentieth century energy development. Within this historical framework, the nature of the relationship of water resources and public health provides an important mirror to the character of human civilization over time. In overview terms, this paper describes man's concern for the water environment from historical and scientific perspectives. Early institutions to manage the public health aspects of water resources, the impact of sanitary engineering on urbanization, and the rise of modern environmental engineering in relation to controlling water pollution are considered. Examined is a number of specific elements illustrating the substantial impact that public health interests have had on water resources planning in the United States. Beyond usual drinking water supply and pollution control matters, the paper touches on public safety, insect-borne disease control, institutional change, and issues associated with broad-based multipurpose water resource development planning. (Bell Graf-Cornell)
W79-06686

WESTERN ECONOMIC DEVELOPMENT AND WATER PLANNING: BUREAU OF RECLAMATION,
Utah State Univ., Logan.
J. E. Keith, K. Wilde, J. C. Andersen, and A. LeBaron.
Journal of the Water Resources Planning and Man-

agement Division, Proceedings of the American Society of Civil Engineers, Vol 105, No WR1, p 161-170, March 1979. 11 ref.

Descriptors: *Water resources development, *Water rights, *Water shortage, *Water allocation(Policy), *History, *Economic development, *Bureau of Reclamation, Municipal water, Recreation, Water plans, Agricultural watersheds.

Reviewed are the early and recent history of the relations between water planning and economic development in the West and Bureau of Reclamation activities. The objectives of Bureau development projects have shifted from the agrarian egalitarian goals of the past to provision of municipal and industrial water and power and recreation and other benefits as the relative benefits to agriculture have declined. The economic efficiency requirements, the environmental movement, and the concommittent comprehensive planning requirements imposed on Federal projects have resulted in the challenge to development which the Bureau currently faces. Bureau supporters come primarily from states that wish to confirm water rights and receive agricultural subsidies in the form of cheap water. The development of vast energy resources and population growth may, however, provide new bases for a resurgence of the engineering solutions of the Bureau to water scarcity and allocation problems in the West. (Bell Graf-Cornell)
W79-06687

PENN STATE RUNOFF MODEL TO PINPOINT FLOOD-PRODUCING SUBAREAS,
Pennsylvania State Univ., University Park. Dept. of Civil Engineering.
For primary bibliographic entry see Field 4A.
W79-06730

A DEMONSTRATION OF AREAWIDE WATER RESOURCES PLANNING,
Metropolitan Washington Council of Governments, DC.
C. S. Spooner, J. Promise, and P. H. Graham.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-280 750, Price codes: A10 in paper copy, A01 in microfiche. Report No. EPA-600/5-78-006a, April 1978. 208 p, 31 fig, 19 tab, 130 ref, 4 append. 16110 FEY and 802149, 14-31-0001-3400.

Descriptors: *Water resources, *Planning, *Future planning(Projected), *Systems analysis, *Computer models, Estimating, Forecasting, Decision making, Methodology, Assessment, Water supply, Water quality, Water pollution sources, Data collections, Social aspects, Environmental effects, Economic impact, Resource allocation, Waste treatment, Runoff, Community development, Washington(D.C.).

A study conducted by the Metropolitan Washington Council of Governments resulted in a Framework Resources Planning Model which is a comprehensive analytical tool to be used in areawide water resources management planning. The linked major physical simulation components test alternative future community development patterns by small area, estimate water demands by usage categories, calculate sewage flows based on waters demands and add infiltration/inflow, simulate storm water runoff, test application of alternative waste treatment management systems, and simulate the quality response of the region's major water body. Methodologies for assessing the fiscal, social, and environmental impacts of alternatives are included in the Model's impact assessment portion. The Framework Model, currently used in planning programs, was tested for the Washington Metropolitan region by identifying the cost-effectiveness of six alternative areawide resources management strategies. (Davison-IPA)
W79-06774

REGULATORY WATER QUALITY MONITORING: A SYSTEMS PERSPECTIVE,
Colorado State Univ., Fort Collins. Dept. of Agricultural and Chemical Engineering.
R. C. Ward.
Water Resources Bulletin, Vol. 15, No. 2, p 369-380, April 1979. 2 fig, 23 ref.

Descriptors: *Water quality, *Monitoring, *Data, Regulation, Legal aspects, Systems analysis.

Regulatory water quality monitoring has evolved to the point where it is a rather complex system encompassing many monitoring purposes and involving many monitoring activities. Lack of a system's perspective of regulatory monitoring hinders the development of effective and efficient monitoring programs to support water quality management. In this paper, the regulatory water quality monitoring system is examined in a total systems context. The purposes of regulatory monitoring are reviewed and categorized according to their legal evolution. The activities of regulatory monitoring are categorized and organized into a system which follows the flow of information through the monitoring program. The monitoring purposes and activities are combined to form a monitoring system matrix--a framework within which the total regulatory water quality monitoring system is defined. The matrix, by defining the regulatory monitoring system and clarifying many interactions within the system, provides a basis upon which a more thorough approach to managing, evaluating, and eventually optimizing regulatory monitoring can be developed. (Bell Graf-Cornell)
W79-06799

TWO-STEP ALGORITHM FOR DESIGN-STAGE LONG-TERM CONTROL OF A MULTI-PURPOSE RESERVOIR,
Institut za Vodoprivredu Jaroslav Cerni, Belgrade (Yugoslavia).
S. Simonovic.
Advances in Water Resources, Vol. 2, No. 1, p 47-49, March 1979. 3 fig, 6 ref.

Descriptors: *Multiple-purpose reservoirs, *Long-term planning, *Algorithms, *Stochastic processes, Design, Probability, Computer programs, Optimization, Linear programming, Chance-constrained programming, Equations, Control, Mathematical models, Systems analysis, Iterative convolution, Random variable.

The algorithm presented herein was developed for solving the problem of long-term control or planning for the functioning of a multi-purpose reservoir pool. It is a stochastic problem, involving random parameters in equations by which the control is defined. The complexity of the problem is imposed by the two-step algorithm for solving the long-term optimal control: (1) explication of all chance constraints on the state and control coordinates is being done at the first step; (2) the choice of optimum control is being done in the second step. The method of iterative convolution has been chosen for the first, and the method of linear programming for the second step. (Bell Graf-Cornell)
W79-06810

DISTRIBUTED ROUTING RAINFALL-RUNOFF MODEL,
Geological Survey, NSTL Station, MS. Water Resources Div.; National Weather Service, Silver Spring, MD. Hydrologic Sciences Div.; and Geological Survey, Reston, VA. Water Resources Div.
D. R. Dawdy, J. C. Schaake, Jr., and W. M. Alley.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-292 303, Price code: A08 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 78-90, September 1978. 146 p, 14 fig, 7 tab, 9 ref.

Descriptors: *Urban runoff, *Storm runoff, *Computer models, *Rainfall-runoff relationships, Storm drains, Drainage systems, Channel flow, Flow characteristics, Land use, Soil moisture, Urbanization, Simulation analysis, Analytical techniques, Surface waters, Hydrographs.

A computer program of a watershed model for routing urban flood discharges through a branched system of pipes or natural channels using rainfall as input has been developed and documented. The model combines soil-moisture-accounting and rainfall-excess components developed by Dawdy and others (1972) with the kinematic-wave routing method presented by Leclerc and Schaake (1973). (Woodard-USGS)
W79-06830

WATER RESOURCES PLANNING USING COMPUTER GRAPHICS,
Cornell Univ., Ithaca, NY. School of Civil and Environmental Engineering.
P. N. French, L. E. Johnson, D. P. Loucks, and D. P. Greenberg.
Preprint 3342, American Society of Civil Engineers (ASCE) Convention and Exposition, Chicago, Ill., October 16-20, 1978. 21 p, 29 fig, 4 ref. OWRT C-7183(6226)(3). 1434-0001-6226.

Descriptors: *Water resources, *Planning, *Computer graphics, *Analytical techniques, River systems, Water quality, Flood control, Regression analysis, Water supply, Linear programming, Simulation analysis, Reservoirs, Multiobjective analysis, Data input, Prediction, Systems analysis.

Presented are computer-aided design methods for water resources planning using interactive computer graphics routines. Four specific types of problems are illustrated: water quality prediction, using simulation and linear programming; flood management, using simulation; reservoir simulation; and multiobjective reservoir-water supply planning which utilizes linear programming. In all cases, tablet digitizing routines have been used for the input of spatial and other data, and vector display methods used for the graphical output. Visual feedback is provided at all stages of the procedures. The interactive computer graphics methods provide many advantages, including convenience, flexibility, the reduction of input errors, and improved communication and response. (Bell-Graf--Cornell)
W79-06861

ESTIMATION OF WATER SURFACE ELEVATION PROBABILITIES AND ASSOCIATED DAMAGES FOR THE GREAT SALT LAKE,
Utah Water Research Lab., Logan.
For primary bibliographic entry see Field 2H.
W79-06894

THE METLAND LANDSCAPE PLANNING PROCESS: COMPOSITE LANDSCAPE ASSESSMENT, ALTERNATIVE PLAN FORMULATION AND PLAN EVALUATION: PART 3 OF THE METROPOLITAN LANDSCAPE PLANNING MODEL,
Massachusetts Univ., Amherst. Dept. of Landscape Architecture and Regional Planning.
J. G. Fabos, C. M. Greene, and S. A. Joyner, Jr.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-296 308, Price codes: A11 in paper copy, A01 in microfiche. Massachusetts Agricultural Experiment Station Research Bulletin Number 653 September 1978. 229 p, 69 fig, 128 tab, 374 ref, 6 append. OWRT-B-029-MASS(5), 14-31-0001-3897.

Descriptors: Bibliographies, *Land use, *Planning, Assessments, *Landscaping, Urbanization.

A three phase landscape planning framework model is developed, including procedures for landscape assessment, plan formulation, and plan evaluation. Assessment procedures identify, locate, estimate quantity and quality, valuate, and map environmental opportunities and constraints. Plan formulation procedures incorporate information from assessment phase into generation of alternative land use scenarios, which meet specified objective scenarios on landscape values, ecological values, and public service resources. Plan formulation and evaluation procedures are interactively accessed from a remote CRT terminal. Application of planning model to 3 Massachusetts communities showed that one future growth scenario, amounting to a 170 percent increase in urbanized area, could occur with no significant loss or impairment

to assessed values. Other growth scenarios incurred significant loss or impairment to assessed values in excess of 600 million dollars. (Godfrey-Mass)
W79-06918

OPTIMAL WEEKLY RELEASES FROM A SEASONAL RESERVOIR 1. DETERMINISTIC FUTURE,
Electro-Watt Engineering Service Ltd., Zurich (Switzerland).
For primary bibliographic entry see Field 4A.
W79-06919

COMPUTER-BASED PROCESS CONTROL,
Maclaren (James F.) Ltd., Willowdale (Ontario).
J. S. Luscombe.
Journal of the American Water Works Association, Vol. 71, No. 3, p 127-132, March 1979. 4 fig, 3 ref.

Descriptors: *Water resources development, *Digital computers, *Plant process control, Costs, Benefits, Optimum development plans, Benefit maximization, Feedback software.

The objective of process control is to obtain the maximum cost benefits from a computer based control system. However, during project development, many things can go wrong, and software costs may drastically increase the total system cost. It is therefore important that water system operators, managers, and engineers know how to select the appropriate hardware and software for a computer-based system. To decide finally whether or not a particular system should be placed under computerized control, the capabilities of the computer must be evaluated. Presented is a checklist describing the specific attributes of a real-time process control computer system. (Bell Graf-Cornell)
W79-06927

WASTEWATER TREATMENT CAPACITY EXPANSION WITH TIME-VARYING ASSIMILATIVE CONSTRAINTS,
TRW Systems Group, Redondo Beach, CA.
For primary bibliographic entry see Field 5D.
W79-06930

STORAGE MASS-CURVE ANALYSIS IN A SYSTEMS-ANALYTIC PERSPECTIVE,
Department of the Environment, Ottawa (Ontario). Inland Waters Directorate.
V. Klemes.
Water Resources Research, Vol. 15, No. 2, p 359-370, April 1979. 6 fig, 1 tab, 61 ref, 1 append.

Descriptors: *Reservoir storage, *Reservoir operation, *Model studies, *Dynamic programming, *Linear programming, *Mass-curve analysis, Optimization, Water policy, Economics, Effects, Streamflow, Design, Equations, Systems analysis, Numerical computation, Shortest path, Stretched-thread method, Minimization, Convex loss functions.

During the past decade, the systems approach to storage reservoir problems has been heralded as something of a jump from the stone age of mass-curve analysis into the modern era of science. In reality, however, no such jump ever occurred; there were a number of small ones but, contrary to the common belief, many of them were confined to the staircase of mass-curve analysis and not all of them were in the upward direction. This paper attempts to put the mass-curve technique into proper perspective by clearing out some undesirable semantic underbrush accumulated over the past decades and by showing an intrinsic identity of some mass-curve and systems-analytic formulations. It demonstrates that, for the important special case of convex loss functions, both the dynamic and the linear programming formulations of optimum reservoir operation policies as developed over the past decade still have a long way to go to match a 55-year old mass-curve technique in terms of exactness and accuracy, as well as computational efficiency. Finally, it shows that the mass-curve technique provides insights into the problems of storage reservoir operation which are entirely out of reach of the systems-analytic methods and can significantly enhance the art of reservoir design and operation. (Bell Graf-Cornell)
W79-06932

WATER QUALITY IN RIVER SYSTEMS: MONTE-CARLO ANALYSIS,
Australian National Univ., Canberra. Centre for Resource and Environmental Studies.
P. Whitehead, and P. Young.
Water Resources Research, Vol. 15, No. 2, p 451-459, April 1979. 9 fig, 2 tab, 25 ref.

Descriptors: *Water quality, *River systems, *Monte Carlo method, *Simulation analysis, *Mathematical models, *Stochastic processes, *Bedford Ouse River(England), *Probability, Forecasting, Downstream, Standards, Effluents, Upstream, Environmental impact, Assessment, Equations, Biochemical oxygen demand, Dissolved oxygen, Aquatic environment, Planning, Statistical methods, Systems analysis, Uncertainty, Sensitivity analysis, Multireach flow, Influents.

Water quality models are described for a 55-km stretch of the Bedford Ouse River in central eastern England. The dynamic models relate time-varying upstream influents to downstream water quality and are stochastic to account for the uncertainty in the system. A stochastic simulation provides forecasts of water quality at a downstream abstraction point in terms of probability distributions, and these are compared with water quality standards, also defined in probabilistic terms. Effluent from the new city of Milton Keynes enters the river at an upstream point, and the impact of the effluent on the aquatic environment is assessed with the sensitivity of the water quality model to parametric uncertainty. (Bell Graf-Cornell)
W79-06935

OPTIMIZATION OF SALINITY CONTROL IN GRAND VALLEY,
Colorado State Univ., Fort Collins. Dept. of Agricultural and Chemical Engineering.
W. R. Walker, G. V. Skogerboe, and R. G. Evans.
Journal of the Irrigation and Drainage Division, Proceedings of the American Society of Civil Engineers, Vol. 105, No. IR1, p 15-28, March 1979. 8 fig, 2 tab, 23 ref.

Descriptors: *Desalination, *Salinity control, *Grand Valley(Col), *Simulation analysis, *Cost-effectiveness, *Optimization, Irrigation efficiency, *Canal linings, Automation, Seepage, Return flow, Drainage, Cost minimization, Structural alternatives, Mathematical models, Systems analysis.

A mathematical simulation of the cost-effectiveness relationship for various agricultural and desalination structural alternatives for reducing salt pickup by irrigation return flows was developed and applied in the Grand Valley of western Colorado. Cost-effectiveness functions developed from the model were then optimized using a least-cost criterion to determine the most cost-effective strategies for salinity control in the valley. The analysis indicates that lining small conveyance channels to reduce seepage and increase the efficiency of the existing furrow irrigation systems should be given the highest priority. Canal lining and desalination of return flows are costly alternatives, but they are feasible when the level of salinity control requires nearly total alleviation of the problem. Some structural alternatives such as field and interceptor drainage exhibited more than an order of magnitude higher costs and should not be considered. (Bell Graf-Cornell)
W79-06936

REDUCING SALT PICKUP FROM IRRIGATED LANDS,
Colorado State Univ., Fort Collins. Dept. of Agricultural and Chemical Engineering.
For primary bibliographic entry see Field 3F.
W79-06937

QUANTITATIVE TECHNIQUES FOR THE ASSESSMENT OF LAKE QUALITY,
Michigan State Univ., East Lansing. Dept. of Resource Development.
For primary bibliographic entry see Field 5A.
W79-06938

REGIONAL DEVELOPMENT PLAN EVALUATION: THE USE OF INPUT-OUTPUT ANALYSIS,
Economics, Statistics, and Cooperatives Service, Washington, DC.
R. McKusick, N. Bills, R. Clark, C. Jones, and R. Niehaus.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-280 951, Price codes: A07 in paper copy, A01 in microfiche. Agriculture Handbook No. 530, May 1978. 132 p, 32 tab, 60 ref, 3 append.

Descriptors: *Regional development, *Planning, *Water resources development, *Comprehensive planning, *Input-output analysis, Land resources, Estimated costs, Income analysis, Employment, Economic impact.

The uses and limitations of input-output (I-O) analysis are examined in the plan evaluation process for water and related land resources by the Federal government. Supply and demand relationships of an economy are depicted by an I-O model which also estimates the indirect economic changes which would occur if such a plan were implemented. The appropriate use of I-O models was studied in U.S. Department of Agriculture (USDA) planning efforts; applied examples are presented of I-O multipliers and models which are consistant with the Water Resources Council's 'Principles for Planning Water and Land Resources' and 'Standards for Planning Water and Land Resources'. Economic information needs associated with regional development as were determined and quantitative methods used to develop this information were assessed before I-O multipliers, models and their application were studied. The application correct procedures for using regional I-O techniques is demonstrated in the estimation of secondary market impacts of plans. Evaluating the feasibility of resource plans for a regional economy as opposed to project justification is emphasized. Although this study is specifically oriented to USDA economists formulating and evaluating plans under various USDA resource programs, it is of potential use for regional planning by Federal, State and local planners. (Davison-IPA)
W79-06941

6B. Evaluation Process

PALMETTO BEND DAM AND RESERVOIR: NEED FOR IMPROVED ANALYSIS OF ALTERNATIVES AND COST DATA.
Comptroller General of the United States, Washington, DC.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-275 328, Price codes: A06 in paper copy, A01 in paper copy. December, 1977. 28 p, 4 append.

Descriptors: *Water resources development, *Water supply, *Water demand, *Palmetto Bend Dam(TX), Water storage, Water requirements, Storage capacity, Inflation, Water costs, Cost trends, Recreation, Reservoirs.

The Palmetto Bend Dam and Reservoir Project, in Jackson County, TX, is designed to provide municipal and industrial water, fish and wildlife benefits, and recreational opportunities. The Bureau of Reclamation is responsible for its construction. This study reviews the cost and schedule experience of the project, the potential use of the project, and the selection process which chose this particular project instead of other alternatives. Since authorization in 1968 the project's estimated cost has more than doubled and additional cost growth is anticipated. The scheduled completion date has been delayed until September 1979, over 2 years from the original estimate. Tables and graphs pres-

ent the cost growth by project feature, and an analysis of the reasons for cost growth; an analysis of the Bureau's reasons for cost increases is also presented. The Bureau said inflation accounted for 90% of the cost increase; GAO's analysis indicated inflation accounted for only 60% of the increase. The study determines that two events which justified the project originally have changed. First, the original population projection which was to increase because of urban expansion has been overly optimistic. Second, industrial expansion may be slowed by the water's high price and cost of the distribution system. Several problems with the Bureau's implementation of federal policies and standards for water and water-related land development projects are presented. (Coan-NC)
W79-06535

REGIONAL SEWERAGE PLANNING BY MIXED INTEGER PROGRAMMING,
North Carolina Univ. at Chapel Hill. Dept. of Environmental Sciences and Engineering.
For primary bibliographic entry see Field 6A.
W79-06542

A PLANNING STUDY FOR IRRIGATION DEVELOPMENT IN WASHINGTON. VOLUME I, EXECUTIVE SUMMARY.
Washington State Univ., Pullman. Dept. of Agricultural Economics.
For primary bibliographic entry see Field 4B.
W79-06544

IRRIGATION DATA BASE FOR ARIZONA,
Sandia Labs., Albuquerque, NM.
I. J. Hall, and S. Vandevender.
Available from the National Technical Information Service, Springfield, VA 22161 as SAND-77-0968, Price codes: A02 in paper copy, A01 in microfiche. Report No SAND 77-0968, January 1978. 25 p. AT(29-1)-789.

Descriptors: *Irrigation, *Arizona, *Irrigation programs, *Basic data collections, *Solar radiation, Energy, Agriculture, Hydrologic data, Irrigation practices, Irrigation systems, Surface irrigation, Wells, Groundwater, Crops, Evaluation, Pumps.

Data describing irrigated agriculture in Arizona were compiled to provide information to determine regions where solar irrigation is most applicable. Arizona was selected for this preliminary data compilation and analysis, because it is the site of the 150 KWe solar irrigation experiment. Tabulated information on the crops grown, the irrigation wells, and irrigation pumps is provided for the following counties in which irrigated agriculture is significant: Cochise, Graham, Maricopa, Pima, Pinal, and Yuma. (Davison-IPA)
W79-06564

FACTORS AFFECTING WATERWAY INVESTMENT DECISIONS,
G. J. Kelnhofer, Jr.
Water Resources Bulletin, Vol. 14, No. 6, p 1423-1428, December 1978. 12 ref.

Descriptors: *Investment, *Decision making, *Inland waterways, *Navigation, *Effects, Evaluation, Water resources, Costs.

There are many factors, other than economic efficiency, which must be considered in judging the merits of proposed investments in the inland navigation system. No satisfactory formula exists for deciding the net worth of public investments in water resources projects. Such a measure would not be accepted because these investments can serve conflicting goals. Political rather than technical, judgments are required to resolve these goal conflicts. (Bell Graf-Cornell)
W79-06670

WATER PLANNING--OVERVIEW,
E. W. Weber.
Journal of the Water Resources Planning and Management Division, Proceedings of the American Society of Civil Engineers, Vol. 105, No. WR1, p 3-7, March 1979.

Descriptors: *Planning, *Water resources, *Cost-benefit analysis, *Legislation, *Water plans, Navigation, Environment, Flood control, Irrigation, Pollution.

The significance of the progression of institutional and procedural techniques in water planning during the past 200 years lies primarily in recognizing that water planning is not merely planning for use of a resource; it is, in effect, planning how to use water wisely to meet the basic needs of people in light of their probable preferences for use of air, water, land, and the environment in general. The lessons learned show the interdependence of water and other resources, the several professional skills needed on planning teams, and the need for displaying alternatives of choice that have the greatest flexibility and probability of satisfying people's needs in the face of continuing change. (Bell Graf-Cornell)
W79-06676

WATER RESOURCES PLANNING--ITS RECENT EVOLUTION,
Clark Univ., Worcester, MA. Dept. of Environmental Affairs.
H. E. Schwarz.
Journal of the Water Resources Planning and Management Division. Proceedings of the American Society of Civil Engineers, Vol. 105, No. WR1, p 27-38, March 1979. 1 fig, 15 ref.

Descriptors: *Water resources, *Planning, *Water plans, *Potomac River basin, *NAR study, *Changes, Government agencies, Effects, Economics, Water supply, Water quality, Benefits, Evaluation.

Planning techniques and procedures have changed greatly in the last 20 years. They have changed because: (1) the techniques of analyses have altered; (2) the institutional setting for planning has varied; and (3) society's values have changed. A review of three cases shows these changes and their evolution: the North Branch of the Potomac report (1961); the Potomac River basin report (1963); and the North Atlantic Regional Water Resources Study report (1973). For each case, the techniques and procedures used in Plan Formulation, Plan Evaluation, Objective Setting, and Decision Making are reviewed. The paper concludes that excellent planning is possible and can become probable if institutional development keeps apace with the developing planning methods. (Bell Graf-Cornell)
W79-06678

ECONOMICS AND WATER RESOURCES PLANNING IN AMERICA,
Utah Water Research Lab., Logan.
L. D. James, and J. R. Rogers.
Journal of the Water Resources Planning and Management Division, Proceedings of the American Society of Civil Engineers, Vol 105, No WR1, p 47-64, March 1979. 66 ref.

Descriptors: Water quality control, *Water plans, *Cost-benefit analysis, *Economics, *History, *Fishing mills, *Social participation, Flood control, Hydroelectric power, Irrigation, Public works, Legislation, Navigation, Natural resources, Projects, Decision making, Design, Programs.

In the United States, the year 1776 marked the beginning of a government dedicated to the development of abundant unclaimed resources for benefit of the common people. It also marked the publication of Wealth of Nations by Adam Smith as the beginning of modern economics. Since then, proponents and opponents of project development schemes for navigation, irrigation, flood control, hydroelectric power, and water quality have seeked economic arguments to support their positions. While economic comparisons have gained widespread application in project design, they have seldom decided project selection. In order to get away from using economics at the project selection level largely to defend decisions already made, economic analysis needs to be restructured by more effective use of the information storage and retrieval capabilities of modern computers so that relevant information from any view point can be quickly provided to people or communities making water management decisions. The goal is to get crusaders to listen to facts before committing themselves and society. (Bell Graf-Cornell)
W79-06680

SOCIAL ASPECTS OF WATER RESOURCES PLANNING,
Miami Univ., Oxford, OH. Inst. of Environmental Science.
G. E. Willeke.
Journal of the Water Resources Planning and Management Division, Proceedings of the American Society of Civil Engineers, Vol 105, No WR1, p 79-90, March 1979. 18 ref.

Descriptors: *Water resources, *Social aspects, *Planning, *Public works, *Social needs, *Social impact, Dams, Economic analysis, Groundwater, Cannel coal, Levees.

Although social goals have always been considered to some extent in major water programs, treating social concerns in a systematic manner is a recent feature of water planning. This reflects the legal requirements for assessing social impacts, a growing understanding of social systems, and recognition that planning is more effective when social factors are considered. From 1776 to 1925, water management structures were small and there was little Federal involvement. Although planning methodology was meager, social factors were given substantial attention. From 1925 to 1960, an era of building large water management structures, there was a strong belief in the efficacy of structural solutions. From 1960 to the present, evidence has accumulated on adverse effects of projects in such magnitude that planning procedures and goals have been modified to give greater attention to equity and social impacts. Public involvement in planning has been mandated. These developments appear to be leading towards the end of the long separation of the social sciences and engineering. (Bell Graf-Cornell)
W79-06682

ECONOMIC ASSESSMENT OF STORM DRAINAGE PLANNING,
Science and Education Administration, Beltsville, MD. Hydrograph Lab.
W. J. Rawls, and R. H. McCuen.
Journal of the Water Resources Planning and Management Division, Proceedings of the American Society of Civil Engineers, Vol 104, No WR1, p 45-54, November 1978. 8 fig, 15 ref.

Descriptors: *Water management(Applied), *Storm sewers, *Urbanization, *Drainage, *Economic analysis, Planning, Hydrology, Detention reservoirs, Costs, Urban development, Assessment, Economic efficiency, Design, Effects, Metropolitan areas.

Factors that planners must consider in the economic evaluation of storm drainage system alternatives include the scale of development, the degree of protection, and the option for including detention storage. A planning tool that requires a limited data base is presented for use in evaluating various possible designs and the effect on total cost of imperviousness, design return period, and the time of concentration. The utility of the above planning tool is demonstrated for three areas: Washington, D.C.; Dallas, Texas; and Los Angeles, California. Improvement in the efficiency of storm drainage systems will reduce both the total cost and the hydrologic impact of development. Both structural measures--such as detention storage--and nonstructural measures--like open space ponding and grass-lined swales--improve the efficiency of storm drainage systems. The effect on cost of increases in the time-of-concentration is examined as an indicator of the efficiency of storm drainage alternatives. (Bell Graf-Cornell)
W79-06688

ECONOMIC ANALYSIS OF STRUCTURAL FLOOD PROOFING,
Colorado Univ., Boulder. Dept. of Civil, Environmental, and Architectural Engineering.
J. E. Flack.
Journal of the Water Resources Planning and Management Division, Proceedings of the American Society of Civil Engineers, Vol 104, No WR1, p 211-221, November 1978. 2 fig, 4 tab, 5 ref.

Descriptors: *Flood control, *Cost-benefit analysis, *Floodproofing, *Waterproofing, Flood routing, Urban planning, Structural, Economic analysis, Annual, Residential, Commercial, Flood damage.

An economic analysis of flood proofing was applied to a case study of residences and commercial establishments in the Boulder Creek flood plain of Boulder, Col. Two alternate plans (one involving nine and the other four items of flood proofing) were analyzed in terms of their costs of installation and the benefits derived from reduced flood damages. Data on levels of inundation for floods up to the 100-yr flood were obtained for each structure in the flood plain from field surveys. Costs of flood proofing were estimated from standard construction cost references. Damages were based on standardized flood depth-damage relationships for the structure and its contents. The results indicate that, in general, flood proofing all structures in a flood plain, such as Boulder Creek, is not economically justified, but that on an individual structure basis some residences and many commercial establishments can be flood proofed at costs less than the benefits derived. (Bell Graf-Cornell)
W79-06689

GROUNDWATER LAW,
For primary bibliographic entry see Field 6E.
W79-06709

A DEMONSTRATION OF AREAWIDE WATER RESOURCES PLANNING,
Metropolitan Washington Council of Governments, DC.
For primary bibliographic entry see Field 6A.
W79-06774

WATER RESOURCES POLICY STUDY: WORKING DRAFTS OF THE TASK FORCE REPORTS,
Water Resources Council, Washington, DC.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-278 989, Price codes: A14 in paper copy, A01 in microfiche. November 11, 1977. 315 p, 13 fig, 10 tab, 6 ref, 5 append.

Descriptors: *Planning, *Management, *Water resources, *Water resources development, Water conservation, Cost sharing, Federal budget, Costs, Environmental control, Water rates, Federal reservations, Flow, Flow augmentation, Groundwater, Water pollution sources, Water quality standards, Administration.

Interim drafts of six task forces which allow the policy committee to monitor the progress of each task force are presented. The drafts express issues being addressed in the policy review and suggest alternative resolutions of each issue. The Task Force on Revision of Water Resource Planning and Evaluation Criteria and Procedures discusses five separate issues and their various options. Eight potential options are identified by the Cost Sharing Task Force to promote water conservation and cost sharing, to reduce the impact on the Federal budget, to obtain equitable distribution of costs, and to assure better environmental protection. The Water Conservation Task Force addresses the Federal role in a national water conservation program, water pricing, Federal programs, and total water management. The Federal Reserved Water Rights Task Group presents three basic viewpoints in managing the Reserved Rights. Five water quality issues, instream flows, flow augmentation, groundwater management, non-point sources, and water quality standards compliance, are determined to be most important by the Water Quality Task Force. The Water Research Policy Task Force's report attempts to develop a national water management process whereby the research needs of the Nation can be met. (Davison-IPA)
W79-06776

MANUAL FOR EVALUATING SECONDARY IMPACTS OF WASTEWATER TREATMENT FACILITIES,
Abt Associates Inc., Cambridge, MA.
M. FitzPatrick, J. Willson, D. Ericson, G. Fax, and D. Wood.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-279 153, Price codes: A09 in paper copy, A01 in microfiche. Report No. EPA-600/5-78-003, April 1977. 184 p, 30 fig, 176 ref. 68-01-3268.

Descriptors: *Waste water treatment, *Treatment facilities, *Publications, *Environmental effects, *Evaluation, *Assessment, Future planning(Projected), Water quality, Surface waters, Groundwater, Economic impact, Wetlands, Wildlife, Habitats, Coasts, Floodplains, Parks, Land use.

Guidelines to aid in assessing the secondary impacts of waste water treatment facility construction are presented. This guide, intended for local officials, EPA Regional staff, and State officials, gives the range of potential secondary impacts, and describes current EPA policy and regulations governing analyses of these impacts. The assessment task is twofold: growth and land use projection, and estimation of environmental impacts resulting from waste water treatment facility induced growth. The 14 areas of secondary impacts covered are categorized into four groups: media impacts, such as ambient noise levels; sensitive environmental area impacts, such as floodplains; unique area impacts, such as parklands; and secondary economic impacts, such as property values. Approaches to refine and improve existing projections of amount, type, and location of projected growth in a service area are described. Application of these approaches is provided for various levels of sophistication, consistent with analysis capability and available resources. Procedure for conducting an initial assessment of the relative seriousness of the 14 types of impacts listed is given. (Davison-IPA)
W79-06777

PROCEEDINGS OF THE BI-STATE CONFERENCE ON THE CHESAPEAKE BAY APRIL 27-29, 1977,
Available from the National Technical Information Service, Springfield, VA 22161 as PB-282 855, Price codes: A07 in paper copy, A01 in microfiche. Report No. EPA 903/9-78-015, Chesapeake Research Consortium, Incorporated. Publication No. 61, October 1977. Conference held at the Patuxent Naval Air Test Center, Maryland, (1977) 310 p, 11 fig, 11 tab, 117 ref. ENV-74-24271A03.

Descriptors: *Chesapeake Bay, *Ecology, *Transportation, *Planning ecosystems, Food, Food chains, Wildlife, Water pollution, Oil spills, Toxicity, Water chemistry, Management, Natural resources, Environmental effects, Environment.

A conference was held to discuss the progress achieved in planning and governing the Chesapeake Bay and some of the current major problem areas perceived by local, regional, State and Federal officials. The list of topics highlighted includes: the Chesapeake Bay Study by the Corps of Engineers; the purpose and nature of the EPA Chesapeake Bay Program; a consensus on the condition of the Bay; maritime development; toxic substances; prevention and control of spills; exploration and research in the Bay; fisheries and wildlife; non-point pollution; coordination in Bay management; inter-state alternatives in coordinating Bay management; and State-Federal alternatives in coordinating Bay management. Responses to each presentation are included. (Davison-IPA)
W79-06778

NATURAL RESOURCE INVENTORY CHECKLIST RESEARCH REPORT NO. 50 SECTION 4: WATER RESOURCES.
Montana Agricultural Experiment Station, Bozeman.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-278 765, Price codes: A03 in paper copy, A01 in microfiche. Report No NSF-RA-E-74-441, February 1974. 27 p. GI29908X.

Descriptors: *Natural resources, *Water resources, *Surveys, Inspection, Investigation, On-site data collections, Environment, Habitats, Water conservation, Water pollution, Wetlands, Aquatic habitats.

A checklist resulting from a literature review and consultations with natural resource experts is presented. It was designed to stimulate ideas, conversation, and an awareness of the complexity of the environment; to aid in identifying local critical issues; and to select the details needed in natural resource inventories. This water resources section covers the following topics: (1) watershed water budget; (2) chemical water quality; (3) visual and aesthetic examination; (4) macrobiological inventory; (5) biological inventory; (6) physical water quality; (7) soils relations; (8) geology relations; (9) water-air resources relations; (10) water pollution inventory; (11) wetlands area; (12) lakeshore and watercourse frontages; (13) water-animal relations; and (14) water-plant relations. (Davison-IPA)
W79-06780

PRELIMINARY ECONOMIC ANALYSIS OF SOLAR IRRIGATION SYSTEMS (SIS) FOR SELECTED LOCATIONS,
Sandia Labs., Albuquerque, NM. Dept. of Systems Analysis.
L. L. Lukens, A. M. Perino, and S. G. Vandevender.
Available from the National Technical Information Service, Springfield, VA 22161 as SAND 77-1403, Price codes: A03 in paper copy, A01 in microfiche. Report No. SAND 77-1403, November 1977. 49 p, 25 fig, 27 tab. AT (29-1)-789.

Descriptors: *Irrigation systems, *Solar irrigation systems, *Irrigation operation and maintenance, *Economic feasibility, Cost analysis, Comparative costs, Electric power costs, Capital costs, Research and development, Agriculture, Crops, Soil types, Evaluation.

A preliminary analysis of the economic feasibility of stand-along solar irrigation systems for certain applications in various locations is described. The life cycle cost (LCC) of the solar irrigation system was compared to the life cycle cost of conventional systems to determine economic feasibility. The LCC of a stand-alone SIS in southern Arizona is 1.5 to 3 times greater than that of a conventional electric system when based on operation for irrigation only between 1980 and 1990. The SIS becomes competitive when 100% of the system capacity is utilized throughout the year, indicating that solar irrigation can be made feasible if the systems can be incorporated into the farm as a power or heat source rather than an irrigation only energy source. Results of SIS designed for five other areas show that SIS LCC is greater than that of electricity as follows: 2 to 4 times higher in the San Joaquin Valley, California; 3.5 to 6.5 times higher in northwestern Nebraska; 2.5 to 5 times higher in central New Mexico; 4.5 to 9 times higher in southeastern Oregon; and 2 to 4 times higher in the southern High Plains of Texas. A hybrid system, solar power with an electrical backup, was examined for southern Arizona. In this case the hybrid becomes economical by 1990 without government incentives or utilization of the total system capacity during the off-season, indicating that SIS should not necessarily be designed for self-sufficiency. (Davison-IPA)
W79-06781

CHESAPEAKE BAY FUTURE CONDITIONS REPORT VOL. 10, APPENDIX 13: ELECTRIC POWER, APPENDIX 14: NOXIOUS WEEDS,

Army Engineer District, Baltimore, MD.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A052 480, Price codes: A03 in paper copy, A01 in microfiche. (1977) 169 p, 20 fig, 18 tab, 76 ref.

Descriptors: *Chesapeake Bay, *Electric power, *Aquatic plants, *Future planning(Projected), *Aquatic weeds, Electric power demand, Electric power industry, Electric power plants, Submerged plants, Pond weeds, Aquatic weed control, Rooted aquatic plants, Sago pondweed, Herbicides.

The impacts of electrical power on the development of the Chesapeake Bay area are discussed in appendix 13. Historical progress, present developments, and future needs and potentials are presented. Historical patterns of energy consumption were analyzed according to current developments in the power industry within a defined market area and its sectors. Future power demands in the market area were estimated through the year 2020. Land and water use were identified as related to the generating capacity mix required to supply the estimated demand. Generating plants were sited through the year 2000 and associated water use was identified. In appendix 14 the types of problems associated with excessive growths of aquatic plants in the Bay and its tributaries are reported. The various types of aquatic plants and the factors affecting their growth are discussed. Past problems involving noxious weeds in the Bay area are surveyed. Pertinent control measures and the advantages and disadvantages of their use are reviewed. (Davison-IPA)
W79-06794

IRRIGATION PLANNING BASED ON WATER DEFICITS,
Southampton Univ. (England). Inst. of Irrigation Studies.
J. R. Rydzewski, and S. Nairizi.
Water Resources Bulletin, Vol. 15, No. 2, p 316-325, April 1979. 3 fig, 1 tab, 6 ref.

Descriptors: *Irrigation, *Projects, *Simulation analysis, *Water deficits, *Underwatering, Planning, Crop yield, Water costs, Cost-benefit analysis, Economic efficiency, Computer models, Effects, Timing, Irrigation water, Water supply, Methodology, Optimization, Systems analysis, Design capacity, Benefit maximization, Equations.

The deliberate underwatering of a larger land area, as practiced in Southern Asia, has provided impetus for systematic investigation into the effects of designing projects for crop water deficits on benefit-cost performance. The study began with the derivation, from published experimental results, of functions relating ultimate crop yield to the magnitude and timing of water deficits, i.e., of the productivity of irrigation water. To obtain the net benefit of the project, the relation between the harvested area and output and the on-farm production costs was then suggested. The cost of supplying the irrigation water to the proposed area and of distributing and applying it to the field was determined, thus completing the benefit-cost equation. A computer simulation model was then established to search for the irrigation project design capacity and area to maximize the net present value in the benefit-cost analysis for the development proposed. In all three cases studied, there appeared good evidence that deliberate underwatering over an extended land area could produce economic (or financial) benefit, this being particularly marked with supplementary irrigation when using mechanized units. (Bell Graf-Cornell)
W79-06797

EVALUATION OF ALTERNATIVES TO THE GARRISON DIVERSION UNIT,
Waterloo Univ. (Ontario). Dept. of Systems Design.
N. M. Znotinas, and K. W. Hipel.
Water Resources Bulletin, Vol. 15, No. 2, p 354-368, April 1979. 9 tab, 15 ref.

Descriptors: *Evaluation, *Multiple-purpose projects, *Water resources development, *Benefits, *Canada, *Garrison Diversion Unit, *Comparison techniques, River basins, Farms, Irrigation, North Dakota, Environmental effects, Decision making, Systems analysis equations, Missouri River, Fuzzy sets, International Joint Commission, Engineering designs, Intagible factors, Qualitative information, Senitivity.

The Garrison Diversion Unit is a multipurpose water resources project which is currently under development for the purpose of diverting water from the Missouri River basin to irrigate farmland in North Dakota. Due to the objections raised by various interest groups, the project has recently been reviewed by the International Joint Commission. This article surveys the background to the project and the various alternatives that have been proposed. By utilizing recently developed fuzzy set techniques, the proposed alternatives are evaluated and a plausible solution is offerred. The study results indicate that it may be advisable to remove the Souris Loop irrigation area from the Garrison project, but the environmental impacts of the study may preclude the implementation of any alternative that can affect Canada. These findings are in partial agreement with the recommendations of the International Joint Commission. (Bell Graf-Cornell)
W79-06798

WILD RIVERS--METHODS FOR EVALUATION,
M. B. Sonnen, and L. C. Davis.
Water Resources Bulletin, Vol 15, No 2, p 404-419, April 1979. 7 fig, 5 tab, 21 ref.

Descriptors: *Wild rivers, *Evaluation, *Methodology, *Benefits, *Water resources economics, *Analytical techniques, Costs, River basins, Environmental effects, Washington, Equations, Recreation, Irrigation, Intangible values, Low development levels, Benefit maximization, Monetary benefits, Nonmonetary benefits.

Two analytical methods are presented and demonstrated for evaluating the monetary and nonmonetary benefits of wild rivers. In the traditional benefit-cost context, special techniques are required to show that any wild river is worthy of preservation. The methods presented allow for the possibility of low development levels in river basins to be optimal, although advanced development can also be shown to be most efficient in some circumstances. That is, the methods are not directed to the wild condition only, but to the entire spectrum of development possibilities. The applications of the methods to two adjacent subbasins in the State of Washington each showed that the currently undeveloped basin should be left in its wild condition, while the partially developed basin next door should be developed even more fully.(Bell Graf-Cornell)
W79-06800

ENERGY ANALYSIS OF REGIONAL WATER POLLUTION CONTROL,
Oregon State Univ., Corvallis.
For primary bibliographic entry see Field 5C.
W79-06802

DESIGN OPTIMIZATION OF HIGH-RATE DISINFECTION USING CHLORINE AND CHLORINE DIOXIDE,
O'Brien and Gere Engineers, Inc., Syracuse, NY.
For primary bibliographic entry see Field 5D.
W79-06803

FUZZY SET APPROACHES TO PLANNING IN THE GRAND RIVER BASIN,
Waterloo Univ. (Ontario). Dept. of Systems Design.
H. Alley, C. P. Bacinello, and K. W. Hipel.
Advances in Water Resources, Vol. 2, No. 1, p 3-12, March 1979. 1 fig, 9 tab, 10 ref.

Descriptors: *Alternative planning, *Decision making, *Grand River basin(Ontario Can), *Cost effectiveness, *Dominance matrix, Water resources, Effects, Design, Data collections, Equations, Systems analysis, *Fuzzy set techniques, Questionnaires, Ranking, Interest groups, Pessimistic aggregation, Mean aggregation, MacDonald analysis.

Fuzzy set approaches are used to analyze alternative solutions to a water resources planning problem in the Grand River basin in Ontario, Canada. The output from questionnaires which were answered by local politicians and other interested parties, provides input data to fuzzy set analyses. The fuzzy set techniques are designed such that non-quantitative and quantitative factors, and the viewpoints of the interest groups, can be readily incorporated into the decision-making process. Ranking of the alternatives is achieved through the use of a dominance matrix which is designed for this purpose. By comparing the ratings of each alternative in the fuzzy set analyses to the cost of the alternative, a comparison is made among the alternatives based upon cost effectiveness. The reasonable results obtained for the Grand River basin application confirm the efficacy of the fuzzy set procedures. (Bell Graf-Cornell)
W79-06809

DEW, FOG AND HYGROSCOPIC FOOD AS A SOURCE OF WATER FOR DESERT ARTHROPODS,
Hebrew Univ., Jerusalem (Israel). Dept. of Entomology.
M. Broza.
Journal of Arid Environments, Vol. 2, No. 1, p 43-49, March 1979, 3 fig, 2 tab, 19 ref.

Descriptors: *Dew, *Fog, *Hygroscopic water, *Invertebrates, *Water balance, Nutrient requirements, Environmental effects, Condensation, Microenvironment, Insect behavior, Moisture stress, Water requirements.

Certain species of desert arthropods are distinguished by their ability to utilize dew and damp hygroscopic material as a source of moisture. The present paper reports the results of field experiments carried out in arid region of Israel to demonstrate how these water sources are exploited by species of isopods, ants, bugs, carabid, coccinellid and several tenebrionid beetles. Numerous investigations of strips of ground in the area were conducted and microclimatological measurements made at the beginning of each observation period. Presented here is a description of one typical night and early morning observation on October 12, 1972 in which two relevent phenomena were observed: (1) direct drinking of dew drops and (2) eating of hygroscopic material which had absorbed water during the night. Observations were carried out immediately after the end of a heat wave and the amount of water gained by tenebrioned beetles following the intake of hygroscopic material was measured and found to be substantial from a summary of data on the occurence of dew and fog in the desert area of Israel, it is concluded that these sources of water could meet the water requirements of many desert arthropods. (Tickes-Arizona)
W79-06834

LOCATION OF MUNICIPAL WELL FIELDS IN AN ENVIRONMENTALLY SENSITIVE REGION,
Geraghty and Miller, Inc., Tampa, FL.
F. H. Dave, and P. J. Schreuder.
Water Resources Bulletin, Vol. 15, No. 2, p 326-336, April, 1979. 4 fig, 10 ref.

Descriptors: *Groundwater, *Water wells, *Well-fields, *Sites, *Environmental effects, Planning, Regional analysis, Florida, Leakance, Water table, Interference.

Potential well-field locations for Hillsborough, Pasco, and Pinellas counties in west-central Florida were determined with a visual selection technique. This technique is based on an understanding of regional hydrology and an appreciation of development goals such as the location of high-yield and low-impact sites. Site-selection criteria include: leakance, depth to water table, depth to nonpotable

water, change in the potentiometric surface, and projected well-field interference. Overlays of each criterion are combined to form a regional composite showing favorable site locations. The actual site-specific values for transmissivity, leakance, storage coefficient, specific capacity, and water quality at the selected locations are determined through a testing program. This technique, with modifications, can be used in other geographic regions. (Purdin-NWWA)
W79-06855

FOUR CORNERS REGIONAL STUDY OF PUBLIC AND LEGISLATIVE OPINION ON WATER AND OTHER NATURAL RESOURCE POLICIES,
Arizona Univ., Tucson. Dept. of Political Science.
H. M. Ingram.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-296 094, Price codes: A04 in paper copy, A01 in microfiche. Project Completion Report, May, 1979. 46 p, 17 tab. OWRT B-056-ARIZ(1). 14-34-0001-7111.

Descriptors: Legislation, Planning, *Water allocation, *Water conservation, Public opinion, Policies.

This project was concerned with public and legislative attitudes about water, energy, environment and other public policy issues. In the area of water resource allocation and development our analysis has shown that, despite all the pressures for change, neither voters nor legislators are willing to ask that any particular users cut back in their use of water. Even irrigated agriculture, which currently uses ninety percent of the water in the region, has the support of the vast majority of both voters and legislators to continue to use the same or more water in the future. This unwillingness to reallocate water away from agriculture to municipal, industrial and other uses exists despite the fact that a large majority of the people polled feel that water shortages are a serious problem. We conclude by suggesting that there will be little change from present water policies if the direction of future water politics is left to these Western voters and their elected state representatives.
W79-06892

FRAGMENTATION OF PUBLIC AUTHORITY OVER FLOODPLAINS: THE CHARLES RIVER RESPONSE,
Massachusetts Univ., Amherst. Dept. of Geology and Geography.
For primary bibliographic entry see Field 6E.
W79-06916

THE METLAND LANDSCAPE PLANNING PROCESS: COMPOSITE LANDSCAPE ASSESSMENT, ALTERNATIVE PLAN FORMULATION AND PLAN EVALUATION: PART 3 OF THE METROPOLITAN LANDSCAPE PLANNING MODEL,
Massachusetts Univ., Amherst. Dept. of Landscape Architecture and Regional Planning.
For primary bibliographic entry see Field 6A.
W79-06918

THE ROLE OF ECONOMIC MODELS IN EVALUATING COMMERCIAL FISHERY RESOURCES,
Maryland Univ., College Park. Bureau of Business and Economic Research.
C. C. Harris, Jr., and V. J. Norton.
American Journal of Agricultural Economics, Vol. 60, No. 5, p 1013-1019, December 1978. 1 fig, 2 tab, 5 ref.

Descriptors: *Fisheries, *Economics, *Regional analysis, *Mathematical models, Evaluation, Marketing, Effects, Decision making, Input-output analysis, Equations, Systems analysis, National.

This discussion is based upon the recognition that there are and increasingly will be pressures to develop regional impact measures for fishery policy decisions. The issue of conceptual and empirical differences between the willingness to pay market value approaches to deriving value estimates is bypassed. Instead, the groundwork has been laid for improved regional analysis to fisheries decisions. Concern has been indicated with standard input-output models and even with the applicability of dynamic input-output models to regional questions. Also, any model that cannot identify economic activity generated from nonproductive transaction costs will provide misleading implications. It is concluded that the appropriate approach is one based on econometric relationships and which allows for dynamic and simultaneous adjustment in relevant variables and even coefficients. Presented as an example is the Harris Model, indicating how its concept of location rent can be adapted to consider regional fisheries questions. It is believed that given the model, the planned adjustments, and appropriate data, the results can provide an important input into many regional issues. It is necessary to account properly for changes in economic activity before net benefits can be derived. (Bell Graf-Cornell)
W79-06926

ANALYSIS OF OPERATIONS AND MAINTENANCE COSTS FOR MUNICIPAL WASTEWATER TREATMENT SYSTEMS,
For primary bibliographic entry see Field 5D.
W79-06955

6C. Cost Allocation, Cost Sharing, Pricing/Repayment

THE EFFECT OF INLAND NAVIGATION USER CHARGES ON BARGE TRANSPORTATION OF WHEAT,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Agricultural Economics.
J. K. Binkley.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-295 632, Price codes: A13 in paper copy, A01 in microfiche. Ph.D. Dissertation, April, 1977, 288 p, 26 tab, 22 fig, 43 ref, 5 append. OWRT B-082-VA (1).

Descriptors: Mississippi River, Inland waterways, *Transportation, *Wheat, User charges, Transshipment models.

This study evaluated the effect of inland navigation user charges on barge wheat movements on both the Mississippi River system and particular segments of the system. In order to accomplish these objectives, transshipment models were constructed, examining three wheat varieties: hard red spring, hard red winter, and soft red winter. The models permitted two types of movements from producing to consuming areas: direct movements or movements through river transshipment points. This allowed the models to choose between barge transportation and competitive modes. Consuming regions were comprised of domestic milling points and foreign countries. Exports to any given point were allowed to move through any of several U.S. ports, depending upon relative transport costs. This gave the models a great deal of flexibility in the export sector, which is critically important for barge transportation of wheat. Data used included 1970-71 wheat production and consumption, and 1975 barge and rail rates, truck costs, and handling costs for each mode. User charges were based on 1974 operation and maintenance costs of the inland waterway system and 1974 barge ton-miles. Base solutions were obtained for each of the models, and then each was run with user charges recovering from 25 to 500 percent of annual operation and maintenance. The effects of uniform charges and charges specific to each waterway were examined.
W79-06731

COST ALLOCATION FOR A REGIONAL WASTEWATER TREATMENT SYSTEM,
SRI International, Menlo Park, CA.
For primary bibliographic entry see Field 5D.
W79-06929

SUBSTITUTING FOR WATER INPUTS IN U.S. MANUFACTURING,
Bankers Trust Co., New York.
C. R. Grebenstein, and B. C. Field.
Water Resources Research, Vol. 15, No. 2, p 228-232, April 1979. 3 tab, 29 ref.

Descriptors: *Water, *United States, *Elasticities of substitution, *Manufacturing sector, Estimating, Capital, Labor, Water prices, Equations, Mathematical models, Systems analysis, Aggregate production functions, Trans-log cost function, Water demand.

Partial elasticities of substitution among capital, labor, and water provide evidence concerning the possibilities of adjusting the techniques of manufacturing to accommodate changing scarcities of water. Empirical estimates of elasticities for the United States are obtained by using a trans-log cost function with SIC two-digit manufacturing data for 1973. Results show that water and labor inputs are good substitutes but that water and capital are complements. Economic implications of this finding are discussed. (Bell Graf-Cornell)
W79-06931

OPTIMAL WATER PRICING AND STORAGE WITH CYCLICAL SUPPLY AND DEMAND,
California Univ., Los Angeles. Dept. of Economics.
J. G. Riley, and C. R. Scherer.
Water Resources Research, Vol. 15, No. 2, p 233-239, April 1979. 1 fig, 19 ref, 1 append.

Descriptors: *Water supply, *Pricing, *Water demand, *Water storage, *Reservoir operation, *Planning, *Optimization, Constraints, Investment, Mathematical models, Systems analysis, Equations, Economic efficiency, Lagrangian analytical framework, Storage capacity, Marginal cost, Peak pricing.

Optimal storage of a naturally renewable, seasonally varying resource is considered where demand is price sensitive and seasonal and social resources are required for storage and processing prior to consumption. The particular application is water supply, where the demand and supply fluctuations are generally out of phase. Using a Lagrangian analytical framework, net willingness to pay is maximized subject to fundamental constraints that characterize water supply and storage. The purpose of this work is to integrate the literatures of peak load pricing and optimal reservoir planning and operation, noting that price is both an active form of 'soft' demand management and an effective information signal for efficient allocation of (non-water) resources in the management of water supply. Results indicate that although demand is assumed to vary continuously with time, the optimal rate structure is approximated by a policy in which the price of water is adjusted at only a few points in the cycle. In contrast with the usual discrete time model, the duration of each subperiod of constant pricing is endogenously determined. It is also shown that owing to the introduction of storage, off-peak prices as well as the peak season price may be held above marginal operating costs, thereby bearing part of the capacity costs. (Bell Graf-Cornell)
W79-06933

6D. Water Demand

ESTIMATION OF RESIDENTIAL WATER DEMAND,
North Carolina State Univ. at Raleigh. Dept. of Economics and Business.
L. E. Danielson.
Economics Research Report No 39, October 1977. 73 p.

Descriptors: *Water demand, *Water supply, *Water rates, *Statistical models, Use rates, Least squares method, Correlation analysis, Time series analysis, Econometrics, Regression analysis, Economics, Peak pricing, Raleigh(NC), Residential water use.

The general purpose of this study is to estimate water demand equations and to analyze whether the policies of peak-load pricing and supply rationing through price adjustment will have an appreciable effect upon water demanded at the household level. The study presents a review of the literature on estimation and projection of water use. The study data are a set of both cross-section and time series meter readings of monthly water use from a sample of residential households in the city of Raleigh, N.C., for the period May 1969 to December 1974. The report discusses the assumptions and applications of the classical least squares model, the covariance model, the random error components model, and the correlated error models. The economic model used in the analysis consists of residential use of water per household as the dependent variable; and average daily rainfall per period, average daily temperature per period, appraised value of house and lot, water price, and size of household as the independent variables. Total residential demand for water is that total quantity of water consumed in a given period for all residential purposes. Other dependent variables include winter demand and sprinkling demand for water. Generally, sprinkling demand was found to be highly responsive to changes in the level of the climatic variables and water price. Household size explained the largest proportion of the variation in the data. The results of this study will aid in evaluating the effect of pricing schemes upon water demand and estimating whether or not such policies should be adopted. (Coan-NC)
W79-06531

MULTIPLE WATER SUPPLY APPROACH FOR URBAN WATER MANAGEMENT,
Weston Environmental Consultants-Designers, West Chester, PA.
For primary bibliographic entry see Field 6A.
W79-06537

PROPOSED 7 YEAR WATER SUPPLY PROGRAM, STATE OF VERMONT.
Vermont State Agency of Environmental Conservation, Montpelier. Div. of Environmental Engineering.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-268 260, Price codes: A05 in paper copy, A01 in microfiche. January 1974, 74 p, 2 fig, 20 tab, 4 append.

Descriptors: *Water resources planning, *Water supply, *Water supply development, *Water utilization, *Water costs, Legislation, Construction costs, Water pollution, Economics, Municipal water, Water quality, Water treatment, Water use, Waste water disposal.

This report evaluates two water supply program changes in Vermont and provides a 7-year projection of costs with a proposal for State assistance for municipal water supply systems. In January 1973 the local assistance federal grant programs for water and sewer system construction funded by the Farmers Home Administration and Dept. of Housing and Urban Development were terminated. These construction grants provided 50% of project costs, with State construction grants of up to 35%. Fifteen communities have been ordered to boil their water, and an additional 71 communities have been ordered to undertake major improvements in their water systems. In addition, 26 communities have been identified as requiring minor improvements. These projects would result in a $75 million construction program; the absence of Federal assistance makes construction of such 'complete projects' economically unfeasible. In the absence of Federal aid, and to help municipalities with public health hazards, those municipalities having the most critical problems are distinguished from the remainder according to the criteria of level of acceptable water quality, extent of covered storage to prevent water contamination, minimum storage capacity to meet demand, and extent of interconnection of system with existing distribution systems. Under these criteria, such 'minimum acceptable project' costs are estimated to be $35,750,000, with the state supplying 70% of the funds. It is recommended that applicable state legislation be amended to award water supply development funds only to municipalities with urgent needs, and that allocation of funds be determined on a dollar amount basis rather than the present percent basis. Proposed legislation is presented. (Arnold-NC)
W79-06538

A PLANNING STUDY FOR IRRIGATION DEVELOPMENT IN WASHINGTON. VOLUME I, EXECUTIVE SUMMARY.
Washington State Univ., Pullman. Dept. of Agricultural Economics.
For primary bibliographic entry see Field 4B.
W79-06544

SYSTEMATIC METHODOLOGY TO NUMERICALLY EVALUATE SCENIC FACTORS OF LANDSCAPE: APPLICATION TO TIPPECANOE COUNTY, INDIANA,
Purdue Univ., Lafayette, IN. Dept. of Geosciences.
For primary bibliographic entry see Field 6A.
W79-06559

DEMAND PROJECTIONS CONSIDERING CONSERVATION,
M. B. Sonnen, and D. E. Evenson.
Water Resources Bulletin, Vol 15, No 2, p 447-460, April 1979. 8 fig, 6 ref.

Descriptors: *Water conservation, *Water demand, *Forecasting, Hawaii, Water supply, Planning, Prices, Mathematical models, Systems analysis, Equations, Effects, Use patterns, Outdoor demands, Family residences, Rainfall, Elasticity, Land use.

Prediction of future water demands depends on the degree to which conservation effects can be anticipated. A model developed for the Corps of Engineers shows that choosing a numerical conservation target to be achieved is more meaningful and yields more predictable results than price or price elasticity manipulations. The method developed and then applied to the Kaneohe Bay region of Oahu considers the following determinants of demand: geographic distribution of the users, indoor and outdoor requirements, time (by year and month of the year), precipitation, historical unit usage rates, gross and irrigable acreage of land uses, price for water, elasticity of demand with respect to price, source of the water supply (local private supplies vs. agency supplies), and the percentage conservation savings anticipated in each future period in indoor and outdoor uses of water in each of 40 possible land uses. (Bell-Graf Cornell)
W79-06796

WATER RESOURCES OF THE POTOMAC RIVER BASIN, WEST VIRGINIA,
Geological Survey, Morgantown, WV. Water Resources Div.
W. A. Hobba, Jr., E. A. Friel, and J. L. Chisholm.
West Virginia Geological and Economic Survey River Basin Bulletin 3, 1977. 110 p, 48 fig, 3 plates, 30 tab, 56 ref.

Descriptors: *Water resources, *West Virginia, *Potomac River, *Groundwater resources, *Water quality, Available water, Water supply, Water demand, Hydrologic data, Streamflow, Runoff, Low flow, Aquifers, Water wells, Water yield, Floods, Surface-groundwater relationships, Groundwater recharge, Water analysis, Chemical analysis, Planning, Water resources development.

This report presents basic information and interpretations regarding the occurrence, availability, and quality of the water resources of the Potomac River basin in West Virginia. The basin includes an area of 3,464 square miles or about 15 percent of the State. The present population is 125,500. Considerable future increases in population, with increases in recreational and industrial expansion, are anticipated. Thus, a knowledge of the water resources is essential in proper planning for development. Virtually all water in the basin is derived from precipitation. Average annual precipitation is 38 inches per year; of this amount 25 inches is returned to the atmosphere by evapotranspiration, 8 inches becomes ground-water recharge, and 5 inches becomes direct overland runoff. Average annual streamflow is 0.9 cubic feet per second per square mile. The carbonate rocks of Berkeley and Jefferson Counties are the best aquifers and may yield more than 600 gallons per minute to individual wells tapping cavernous zones. The shale rocks of the central part are generally the poorest aquifers. The chemical quality of both surface water and ground water is very poor to excellent, depending on location. (Woodard-USGS)
W79-06813

PUBLIC AND INDUSTRIAL WATER SUPPLIES OF NORTHERN MISSISSIPPI, 1975,
Geological Survey, Jackson, MS. Water Resources Div.
J. A. Callahan.
Mississippi Board of Water Commissioners Bulletin 79-1, 1979. 79 p, 7 fig, 49 tab, 35 ref.

Descriptors: *Water supply, *Surface waters, *Groundwater, *Water quality, *Water utilization, Hydrologic data, Aquifers, Well data, Water levels, Water yield, Water demand, Water analysis, Chemical analysis, Municipal water, Industrial water, *Northern Mississippi.

Public and industrial water withdrawals for the 45 counties of northern Mississippi amounted to more than 520 million gallons per day in 1975. Water usage was divided about equally between groundwater and surface-water sources. Ground-water pumpage for public supplies and self-supplied industry was 78 and 143 million gallons per day, respectively. Rural water use was 12 million gallons per day exclusive of irrigation. Of the total usage, 291 millions gallons per day was from surface-water sources primarily for cooling water. Industrial water is obtained from Lake Ferguson and the Sunflower River. The city of Columbus, pumping from Luxapallila Creek, is the only public supply using surface water; all other public supplies are obtained from wells. Producing aquifers ranged in age from Paleozoic to Holocene. The most widely used aquifers are the Meridian-upper Wilcox and the Sparta Sand, both of Eocene age. The largest withdrawal, over 74 million gallons per day, is made from the Mississippi River Valley alluvial aquifer. (Woodard-USGS)
W79-06827

6E. Water Law and Institutions

PALMETTO BEND DAM AND RESERVOIR: NEED FOR IMPROVED ANALYSIS OF ALTERNATIVES AND COST DATA.
Comptroller General of the United States, Washington, DC.
For primary bibliographic entry see Field 6B.
W79-06535

WATER QUALITY MANAGEMENT PLANNING IS NOT COMPREHENSIVE AND MAY NOT BE EFFECTIVE FOR MANY YEARS.
Comptroller General of the United States, Washington, DC.
U.S. General Accounting Office, Publication No CED-78-167, December 11, 1978. 49 p, 7 append.

Descriptors: *Federal Water Pollution Control Act, *Water quality, *Water quality control, *Regulation, *Water quality standards, *Water management(Administrative), *208 planning, Planning, Water pollution control, Water law, Water pollution, Water resources.

In this report to the House of Representatives, the General Accounting Office (GAO) analyzes the effectiveness of Implementation of the 208 water quality planning program by the U.S. Environmental Protection Agency (EPA) since passage of the 1972 Federal Water Pollution Control Act (P.L. 92-500). Findings indicate that EPA's management of the 208 program has been costly and that more

effective agency planning with regard to standards setting and funding for state programs is needed. Initial funding for state 208 programs did not occur until more than a year after passage of P.L. 92-500, and after funding EPA did not vigorously follow through in seeing that states meet requirements of Section 208 on time, due to inadequate time frames imposed on states in the first place. GAO recommends that public participation play a more important role in the 208 planning process, and that EPA should reassess the 208 program and report to Congress on how long it will take to get adequate data on future effective program planning, and what planning alternatives to the 208 program are possible. Greater special interest group involvement is also recommended. Oregon's 208 program is cited as a model partly due to that state's efficient use of remote sensing and aerial photography data to determine river basin water quality problems earlier in the stages of its program. (Arnold-NC)
W79-06536

SOUTH COASTAL WATER QUALITY MANAGEMENT PLAN, 1975.
Massachusetts Div. of Water Pollution Control, Westborough.
For primary bibliographic entry see Field 5G.
W79-06543

CENTER PIVOT IRRIGATION IN THE COLUMBIA BASIN OF WASHINGTON AND OREGON: DYNAMICS AND IMPLICATIONS,
Oregon State Univ., Corvallis. Dept. of Geography.
K. W. Muckleston, and R. M. Highsmith, Jr.
Water Resources Bulletin, Vol. 14, No. 5, p 1121-1128, October 1978. 1 fig, 13 ref.

Descriptors: *Irrigation, *Columbia River Basin, *Effects, *Water law, Washington, Oregon, Technology, Investment, Capital, Markets, Thermoelectric energy, Institutions, Socioeconomic characteristics, Small towns.

As of 1976, over 225,000 acres were being irrigated by center pivot units in a five-county area of the Columbia Basin in Oregon and Washington. Most of the development occurred since 1970. Dynamic application of center pivot technology altered the concept of irrigability in the study area, converting lands that were often rolling, sandy, and plagued by wind erosion from low grade grazing to productive irrigated units. This development was entirely by private enterprise, with large corporate farms accounting for much of the effort. Little prior comprehensive planning or coordination took place. When the circulation of water is altered on such a massive scale, however, unplanned impacts may be far reaching. In this case they include: (1) acceleration of the shift to high cost thermoelectric generation; (2) alteration of the state institutions designed to allocate water; and (3) possible significant alterations of the socio-economic fabric of small rural service centers. (Bell-Graf--Cornell)
W79-06674

STATE WATER QUALITY CONTROL PROGRAM IN ARIZONA,
Arizona State Dept. of Health, Phoenix. Environmental Health Service.
R. L. Miller.
Water Resources Bulletin, Vol. 14, No. 6, p 1503-1506, December 1978.

Descriptors: *Water quality conrol, *Programs, *Arizona, *Legislation, Public law, Point source, Nonpoint source, Standards, Areawide planning, Plan review, Facilities inspections, NPDES, Enforcement, Operator certification, Monitoring, Construction grants.

Arizona's water pollution control program is based on authorities of Arizona Revised Statutes and Public Law 92-500, the Federal Water Pollution Control Act Amendments of 1972. The primary areas of this program are monitoring, facility inspections, plan review, planning, discharge permits and grants for the construction of publicly owned waste water treatment facilities. The discharge permit program deals with control of point-source discharges and is administered by the United States Environmental Protection Agency. The planning and construction grants programs are administered by the State Water Quality Control Council and are implemented by the Bureau of Water Quality Control, which serves as staff to the Council. There are several challenges that face the State in this program. First is the adaptation of the 'eastern law' to deal with Arizona's water quality problems. Second is to address problems caused by a long history of 'laissez-faire' environmental quality management. Third is a mutual cooperation and coordination among the many entities involved in water quality standards and the involvement of people of diversified backgrounds in the field of areawide planning under Section 208 of the Federal Water Pollution Control Act, which is primarily concerned with non-point sources of water pollution. (Bell Graf-Cornell)
W79-06675

WATER RESOURCES PLANNING--HISTORICAL DEVELOPMENT,
National Research Council, Washington, DC. Environmental Studies Board.
T. M. Schad.
Journal of the Water Resources Planning and Management Division, Proceedings of the American Society of Civil Engineers, Vol. 105, No. WR1, p 9-25, March 1979. 55 ref.

Descriptors: *Water resources, *Planning, *Statistical analysis, *Government agencies, *Public works, *History, Waterways, Estimating, Water policy, Forecasting, Conservation, Navigation, Transportation, United States, U.S. Corps of Engineers.

Water resources planning in the United States had its origin in efforts to improve waterways for navigation. Early planning was accomplished by the U.S. Army Corps of Engineers in connection with the construction of projects. Growth and development of the country led to a proliferation of government agencies involved in water resources, and the planning process gradually increased in complexity. The 'New Deal' in the 1930's resulted in increasing centralization of planning, but in the 1960's an effort was made to regionalize the planning process. Various committees and commissions have made recommendations for improvement of the planning process, and the planning techniques continue to evolve. The point has now been reached where many years of planning are required before a project can be developed to meet a perceived demand for water or water-related services. (Bell Graf-Cornell)
W79-06677

GROUNDWATER LAW,
K. Browning.
Pacific Groundwater Digest, Vol. 2, No. 3, p 29-30, March, 1979.

Descriptors: *Groundwater, *California, *Water management(Applied), *Legislation, *Groundwater basins, Water resources, Financing.

New groundwater legislation in California will require the State Water Resources Board to designate groundwater management areas, conduct groundwater resources investigations, and make recommendations for groundwater management areas. In addition, each area will be controlled by a local groundwater management authority who will submit a comprehensive management plan and send biennial reports to the governing board. These authorities will be financed through groundwater extraction charges and basin equity assessments. Other states, such as Nevada and Oregon are divided into groundwater basins. The State Water Resources Board studies and monitors the amount of discharge and recharge in each basin and have the authority to halt usage of groundwater only in critical areas. (Purdin-NWWA)
W79-06709

PROCEEDINGS OF THE BI-STATE CONFERENCE ON THE CHESAPEAKE BAY APRIL 27-29, 1977,
For primary bibliographic entry see Field 6B.
W79-06778

SHORELINES MANAGEMENT '77: PERFORMANCE AND PROSPECTS.
Washington Univ., Seattle. Div. of Marine Resources.
For primary bibliographic entry see Field 6G.
W79-06786

SAN LUIS VALLEY WATER PROBLEMS: A LEGAL PERSPECTIVE,
Colorado State Univ., Fort Collins. Dept. of Economics.
G. E. Radosevich, and R. W. Rutz.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-295 918, Price codes: A06 in paper copy, A01 in microfiche. Colorado Water Resources Research Institute, Colorado State University, Information Series No. 34, January 1979. 109 p, 8 append. OWRT C-7144(6211)(1). 14-34-0001-6211.

Descriptors: *Water rights, Water law, Interstate compacts, *Irrigation, Institutions, Colorado, San Luis Valley, Rio Grande River.

The San Luis Valley stands at the crossroads of its economic future. Because of the existing water distribution system in the Valley and the superimposed legal system and legal constraints, a deep insecurity has arisen among the people. Suspicion and economic fear are facts of life. As a result, a number of lawsuits have been filed during the past year, thereby deepening the division already present and draining large amounts of money out of the Valley to law firms located primarily in Denver. Presently, the Valley is a patchwork of local conservancy districts, ditch companies, drainage districts, water users associations, etc., all interested in protecting their own areas of concern at the expense of any other person or group which might be deemed a threat to their interest. With the Closed Basin Drainage Project beginning, it is possible that there is enough water present in the Valley to fulfill existing water requirements without substantially harming the existing pattern of water use. To approach this objective a spirit of cooperation and trust must be developed, and a basic review of the legal principles controlling water must be made. The purpose of this report is to describe the water law condition and problems in the Valley. The following areas are discussed: the Rio Grande River and Colorado's commitments thereunder; the Closed Basin Project; Water Rights and Organizations in the Valley; Problems and Conflicts in the Valley; Developments in Colorado Water Law since 1973; and An approach to resolving the water problems now and in the future.
W79-06859

FOUR CORNERS REGIONAL STUDY OF PUBLIC AND LEGISLATIVE OPINION ON WATER AND OTHER NATURAL RESOURCE POLICIES,
Arizona Univ., Tucson. Dept. of Political Science.
For primary bibliographic entry see Field 6B.
W79-06892

THE 208 PLANNING APPROACH TO GROUND WATER PROTECTION--WHAT IS WRONG AND WHAT CAN BE DONE ABOUT IT,
For primary bibliographic entry see Field 5G.
W79-06904

THE 208 PLANNING APPROACH TO GROUND WATER PROTECTION - A FOOT IN THE DOOR,
Illinois Environmental Protection Agency, Springfield.
For primary bibliographic entry see Field 5G.
W79-06905

THE 208 PLANNING APPROACH TO GROUND-WATER PROTECTION - A PROGRAM OVERVIEW,
Environmental Protection Agency, Washington, DC. Water Planning Div.
For primary bibliographic entry see Field 5G.
W79-06906

FRAGMENTATION OF PUBLIC AUTHORITY OVER FLOODPLAINS: THE CHARLES RIVER RESPONSE,
Massachusetts Univ., Amherst. Dept. of Geology and Geography.
R. H. Platt, and G. M. McMullen.
Ivailable from the National Technical Information Service, Springfield, VA 22161 as PB-296 316, Price codes: A06 in paper copy, A01 in microfiche. University of Massachusetts Water Resources, Research Center Publication No. 101, 1979. 112 p, 8 fig, 8 tab, 38 ref, 3 append. OWRT-A-101-MASS (1), 14-34-0001-8023.

Descriptors: *Floodplain insurance, *Flood plain zoning, *Flood protection, Flood control, Massachusetts, Non-structural alternatives, Water law, Water policy, *Water management, Alternative planning, *Charles River.

Public authority to manage floodplains in the United States is fragmented among diverse political bodies: states, special district, counties, and municipalities. Each unit is vested with specific powers affecting the use of land and water resources within its boundaries. Differences in the plans, policies, and actions of individual entities give rise to adverse externalities affecting upstream, downstream, and cross-stream interests. Flooding may be increased in stage, frequency, and rapidity due to constriction of the channel or floodplain. This reduces the effectiveness of floodplain management efforts, both structural and non-structural in neighboring areas. Issues arising from incompatible floodplain practices concern: (1) management versus non-management; (2) structural versus non-structural; (3) levels of protection; (4) compatibility of regulations; (5) natural flood storage areas. Joint undertakings which raise problems of coordination involve: (1) joint regulation; (2) joint acquisition; and (3) extraterritorial authority. The Charles River Watershed in Massachusetts is the scene of a complex experiment in intergovernmental floodplain management. Both structural and non-structural measures are employed. Participants include federal, state, regional, and local entities. Experience to date is examined and unresolved issues are set forth. (Godfrey-Mass)
W79-06916

6G. Ecologic Impact Of Water Development

SUBSIDENCE AND RELATED EFFECTS ON WASTEWATER COLLECTION AND TREATMENT FACILITIES.
Gulf Coast Waste Disposal Authority, Houston, TX.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-276 579, Price codes: A04 in paper copy, A01 in microfiche. Final Report 1976. 62 p, 1 fig, 2 tab, 29 ref.

Descriptors: *Land subsidence, Groundwater, *Water table, *Water quality, Texas, *Inflow, Water treatment, Performance, *Tides, Floods, Sewerage, Gulf coastal plain, Coliforms.

Land subsidence in the Houston area and its effects on domestic facilities and collection systems were investigated. A literature search indicated that inflow due to tidal flooding of previously dry areas was the only verifiable impact of land subsidence due to groundwater withdrawal. The mapping of Houston area subsidence-affected land areas and domestic water treatment plants involved identifying and mapping tidal flood-prone areas. Communities whose service areas or sewage plants had become partially inundated by regular flood tides were identified. The effects of subsided treatment plants on water quality involved increases in organic and nutrient loads and coliform bacteria contamination resulting from reduced waste water treatment facility efficiency. Twenty reports and articles dealing with land subsidence in general or land subsidence in the Houston area are summarized. (Small-FIRL)
W79-06562

WATER PLANNING AND THE ENVIRONMENT: 1776-1976,
Stanford Univ., CA. Dept. of Civil Engineering.
L. Ortolano.
Journal of the Water Resources Planning and Management Division, Proceedings of the American Society of Civil Engineers, Vol 105, No WR1, p 65-78, March 1979. 37 ref.

Descriptors: *Water resources, *Planning, *Environment, *Natural resources, *History, *Interagency cooperation, Federal government, Conservation, Government agencies, Social needs, Effects, Ecology, Economic decision criteria, Impact assessment.

The history of the ways in which environmental factors have been integrated into water resources planning is divided into three periods. During the first period, the years from 1776 to 1900, there was relatively little concern over the environmental impacts of water projects. The second period, from 1900 to 1970, represents a term during which environmental issues were concerned largely with the elimination of recklessness and waste and the efficient utilization of water resources. Environmental factors sometimes received consideration as a result of the concerns of citizens' groups and as a result of interagency coordination requirements. The third period, the years since 1970, represents a time during which water resources agencies have been routinely faced with a host of environmental concerns. Some of these relate to principal problems of the previous period, i.e., the efficient use of resources. Others however, e.g., the preservation of scarce natural environments and the maintenance of ecological stability and diversity, are relatively new issues. (Bell Graf-Cornell)
W79-06681

PACIFIC NORTHWEST RIVER BASINS COMMISSION: ANNUAL REPORT, FISCAL YEAR 1976,
Pacific Northwest River Basin Commission, Vancouver, WA.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-280 947, Price codes: A02 in paper copy, A01 in microfiche. 1976. 20 p, 9 fig.

Descriptors: *Water resources, *Water resources development, *Regional development, *Pacific Northwest U.S., *Columbia River basin, Kootenai River Basin(Montana), Snohomish River Basin(Washington), *Land use, Comprehensive planning, Future planning(Projected), Environmental effects, Natural resources, Social aspects, Water policy.

The activities and programs of the Pacific Northwest River Basins Commission are summarized for the period July 1, 1975 through June 30, 1976. The Commission is preparing a water and related resources program intended to serve as a guide to decision makers. When completed, it will establish goals and objectives; identify issues, problems, and needs of the region; and offer programs for the best uses and institutional arrangements for managing the region's water and related resources. The Columbia River Estuary Special Proposal was forwarded to the Water Resources Council for funding along with the Snohomish River Basin Proposal to Study and a Proposal to Study for a Level B investigation of the Kootenai River Basin in Montana and Idaho. The 'Stewards of the River' program continued its objective to enhance the cultural, historical, educational, and esthetic aspects of the Columbia River and its major tributaries. Activities of the standing committees are reviewed, and a financial statement is included. (Davison-IPA)
W79-06771

UPPER MISSISSIPPI RIVER BASIN COMMISSION,
Upper Mississippi River Basin Commission, Twin Cities, MN.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-280 950, Price codes: A02 in paper copy, A01 in microfiche. Fifth Annual Report, 1976. 22 p, 14 fig.

Descriptors: *Water resources, *Water resources development, *Upper Mississippi River Basin, *Land use, *Comprehensive planning, Future planning(Projected), Environmental effects, Natural resources, Social aspects, Regional development, Water policy, Red River Basin(Minnesota).

The activities and programs of the Upper Mississippi River Basin Commission are summarized for the period July 1, 1975 through September 30, 1976. The U.S. Water Resources Council approved of the Commission's Proposal for the Study of the Upper Mississippi River Main Stem Level B program which was scheduled to begin during fiscal 1977. The ongoing coordinated management program is discussed. The Level B Study of the Water and Related Land Resources of the Minneapolis/St. Paul Metropolitan Area was completed in June 1976. A Comprehensive, Coordinated Joint Plan (CCJP) was adopted by the Commission for the Souris-Red-Rainy and Upper Mississippi Regions. The Commission has requested the U.S. Water Resources Council to provide $720,000 for a 2-year water related land resources study in the Red River Basin. The Commission's participation in the National Assessment of the Nation's water and related land resources is discussed, the Commission's CCJP is examined, and statewide planning assistance is reviewed. A financial statement is provided. (Davison-IPA)
W79-06772

MISSOURI RIVER BASIN COMMISSION ANNUAL REPORT, FISCAL 1976 AND TRANSITIONAL QUARTER,
Missouri River Basin Commission, Omaha, NE.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-280 948, Price codes: A02 in paper copy, A01 in microfiche. 1976. 18 p, 12 fig.

Descriptors: *Water resources, *Water resources development, *Missouri River Basin, Comprehensive planning, Future planning(Projected), Environmental effects, Natural resources, Water policy, Land use, Regional development, Platte River Basin(Nebraska).

The activities and programs of the Missouri River Basin Commission are summarized for the period July 1, 1975 through September 30, 1976. The continuous planning effort of the Commission is embodied in the comprehensive, coordinated joint plan (CCJP) which currently consists of two elements: the conclusions and recommendations of the 1971 Framework Study Report, and the comprehensive plan developed by the 1976 Platte River Basin, Nebraska, Level B Study. The Platte River Basin of Nebraska is the first area to be included in a CCJP plan. A similar planning effort, the Yellowstone Basin and Adjacent Coal Field Area Level B Study, is underway. The Commission prepared and published two technical memoranda as part of the National Assessment program: a compilation of problems relating to the Basin's water and related land resources, and refinement of these problems along with water-oriented data for the Basin. The setting of priorities is discussed. The 'Federal and State Program Review' contains a comprehensive review of the water and related land resources studies, research, data collection, and implementation of projects and programs within the Basin. Committee activities are reported; a financial statement is included. (Davison-IPA)
W79-06773

PROCEEDINGS OF THE BI-STATE CONFERENCE ON THE CHESAPEAKE BAY APRIL 27-29, 1977,
For primary bibliographic entry see Field 6B.

W79-06778

GREAT LAKES BASIN COMMISSION: 1976 ANNUAL REPORT,
Great Lakes Basin Commission, Ann Arbor, MI.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-281 042, Price codes: A03 in paper copy, A01 in microfiche.

Descriptors: *Water resources, *Water resources development, *Great Lakes Basin, Planning, Comprehensive planning, Future planning(Projected), Environmental effects, Natural resources, Water policy, Water quality, Erosion, Land use, Sedimentation, Flood control, Recreation, Fish, Wildlife, Management, Social aspects, Regional development.

Highlights of the activities, programs, studies and a financial statement for the period July 1, 1975 through September 30, 1976, are reported. Among the members of the Great Lakes Basin Commission are the States of Illinois, Indiana, Michigan, Minnesota, New York, Ohio, Pennsylvania, and Wisconsin. During the period the Commission continued to advocate increased State responsibility and involvement in all planning activities. Work began on the comprehensive coordinated joint plan for the Great Lakes. This is a broad effort to guide the use of water related resources as far as 50 years into the future. The Great Lakes Basin Framework Study, a comprehensive basic study on the Great Lakes System, was completed. The National Water Assessment--Great Lakes Region is scheduled for completion in 1978. 'Great Lakes Basin Programs 1976-1977' describes planning, research, and data acquisition programs conducted by government agencies during 1976. Progress is reported on Level B studies and policy studies. Activities of the various standing committees and States are reviewed. The Great Lakes Basin Library, open to the public, is a Selected Federal Depository Library and receives all Federal publications pertaining to water and land in the Great Lakes Basin. (Davison-IPA)
W79-06784

SHORELINES MANAGEMENT '77: PERFORMANCE AND PROSPECTS.
Washington Univ., Seattle. Div. of Marine Resources.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-281 928, Price codes: A08 in paper copy, A01 in microfiche. Report No WSG-W077-3, Washington Sea Grant Communications Program, Proceedings of a Conference held September 22-23, 1977, Seattle, Washington, 171 p, 2 fig, 1 tab, 18 ref, Goodwin, R. F., Editor.

Descriptors: *Planning, *Management, *Coasts, *Washington, Community development, Environment, Environmental effects, Cities, Estuaries, Shores, Conservation, Land management, Water resources development, Harbors, Recreation, Marinas, Legal aspects, Legislation, Zoning, Beaches, Lakes, Streams.

Twenty papers by authorities from government, academia, and other institutions are provided that deal with coastal management. The broad areas of coverage are: shoreline environmental management and community development, policies and guidelines for managing aquatic areas, legal and legislative issues, and shorelines management administration. (Davison-IPA)
W79-06786

NEW ENGLAND RIVER BASINS COMMISSION.
New England River Basins Commission, Boston, MA.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-280 949, Price codes: A02 in paper copy, A01 in microfiche. Annual Report, 1976. 20 p, 11 fig, 4 append.

Descriptors: *New England River Basins Commission, *Planning, *Management, *Water resources, *Land managements, *Environmental control, Water resources development, Regional development, River basin development, River basins, Continental shelf, Flood plains, Connecticut River.

During 1976 New England's attitude was for environmental management and protection. Although [illegible] development with strong environmental controls, economic growth was also a goal. The New England River Basins Commission (NERBC) is responsible for preparing and keeping up-to-date a Comprehensive, Coordinated Joint Plan which recommends ways in which Federal, State and local governments and other institutions can manage water and related land resources wisely. The NERBC conducts individual studies dealing with complex severe regional problems and prepares basin 'planning guides.' The progress of the following studies is summarized: the Connecticut River Basin, Southern New England Basins, New Hampshire Basins, Lake Champlain Basins, and Maine Basins. Onshore oil and gas facilities are discussed. The activities of the Coastal Zone Task Force and the Outer Continental Shelf Task Force are reviewed. Preliminary conclusions regarding the NERBC's 1975 Assessment of Water and Land Resources are presented. The Task Force on Flood Plain Management focused on the three national programs: The National Flood Insurance Program, the Water Resources Council's unified national program for flood plain management, and new Federal regulations for wetland dredge and fill activity. A publications list and financial summary are included in the appendices. (Davison-IPA)
W79-06790

CHESAPEAKE BAY FUTURE CONDITIONS REPORT, VOLUME 4, APPENDIX 4: WATER RELATED LAND RESOURCES.
Army Engineer District, Baltimore, MD.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A052 474, Price codes: A02 in paper copy, A01 in microfiche. (1977). 294 p, 70 fig, 29 tab, 274 ref, 4 append.

Descriptors: *Land resources, *Chesapeake Bay, *Future planning(Projected), *Land development, *Natural resources, *Water resources, Agriculture, Forestry, Mineralogy, Mapping, Regional development, Environmental effects, Delaware, Maryland, Virginia, District of Columbia, Social impact.

Findings of the Chesapeake Bay Study regarding future conditions of the region's land resources are presented. The study, coordinated with all Federal, State, and local agencies having interests in the Bay, includes the multi-disciplinary fields of engineering and the social, physical, and biological sciences. The study area was comprised of: The State of Delaware; Maryland excluding Frederick, Washington, Allegany, and Garrett counties; the Coastal Zone of Virginia; and Washington, D.C. Existing land use mapping was developed from U.S. Geological Survey maps, and future land use was projected and mapped by using county and regional comprehensive plans produced by local and regional planning agencies. The most current available data on water-related land resources of agriculture, forestry, and minerals were used to assess the present status of each land resource, project the future conditions of each, and determine the future problem areas of each resource. Future water resource needs and problem areas are projected to the year 2020. Recommendations for future studies and model testing required for developing a comprehensive management program for the Bay are included. (Davison-IPA)
W79-06793

CHESAPEAKE BAY FUTURE CONDITIONS REPORT VOL. 10, APPENDIX 13: ELECTRIC POWER, APPENDIX 14: NOXIOUS WEEDS,
Army Engineer District, Baltimore, MD.
For primary bibliographic entry see Field 6B.
W79-06794

CHESAPEAKE BAY FUTURE CONDITIONS REPORT, VOLUME 12, APPENDIX 16: HYDRAULIC MODEL TESTING,
Army Engineer District, Baltimore, MD.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A052 482, Price codes: A05 in paper copy, A01 in microfiche. (1977), 72 p, 3 fig, 3 tab, 2 append.

Descriptors: *Chesapeake Bay, *Hydraulic models, *Model studies, *Hydraulic similitude, Research and development, Prototype tests, Tributaries, Physical properties, Salinity, Temperature, Elevation, Currents(Water), Velocity, Sea level, Sediments, Inflow, Freshwater, Baltimore Harbor, Estaurine environment.

The formulation of a first year hydraulic studies program for the Chesapeake Bay Hydraulic Model is reported. The hydraulic model of Chesapeake Bay provides a means of reproducing many natural events and man-made changes on a manageable scale, so that the necessary data may be collected to assess the results of these happenings. The model, located at Matapeake, Maryland, is a fixed bed geometrically distorted scale model hand molded in concrete; its nine acre area encompasses the Bay proper, all its tributaries up to the head of tidal effects, and the adjacent overbank areas to the contour of 20 ft above mean sea level. The model is expected to reproduce physical prototype data for the following: water surface elevation, salinity, current velocity, dye concentration from dye dispersion tests, temperature, and sediment distribution. The tests selected for the first year of testing were (1) Low Freshwater Inflow Study; (2) Baltimore Harbor Channel Enlargement Study, and (3) Combined Potomac Estuary Water Supply and Waste Water Dispersion Study. Other problems considered for inclusion in the first year studies program, and a priority ranking of the problems based on their economic, environmental and social impacts are discussed. The costs for operation and maintenance of the model complex during the performance of the three studies, estimated on the basis of October 19, 1976 prices, are $2,150,000. (Davison-IPA)
W79-06795

THE PREDICTABILITY OF RAIN AND THE FORAGING PATTERNS OF THE RED KANGAROO (MEGALEIA RUFA) IN CENTRAL AUSTRALIA,
Michigan Univ., Ann Arbor. School of Natural Resources.
B. S. Low.
Journal of Arid Environments, Vol. 2, No. 1, p 61-76, March 1979, 5 tab, 4 fig, 50 ref.

Descriptors: *Animal populations, *Animal behavior, *Food habits, *Kangaroos, *Rainfall disposition, Vegetation effects, Distribution patterns, Population dispersion, Density, Balance of nature, Environmental effects, Succession, Predation, Wildlife management, Seasonal, Australia, Forages, Biological communities, Forecasting.

Because the fate of desert animals is of increasing concern throughout the civilized world, studies of the adaptation mechanisms of desert wildlife to conditions of aridity are important in long-term efforts to preserve species most subject to man's predation. This particular investigation of the habitat of the red kangaroo (Megaleia rufa) in Australia's central desert considered how the amount, variation, and predictability of rainfall affected the density and dispersion of feeding kangaroos, and how these effects interacted with other parameters such as the vegetative composition of the community, season, available free water, and cover. Rainfall was measured weekly by 20 gages and soil moisture computed by .8 km square quadrats. Aerial surveys were flown three times per month to determine kangaroo density and dispersion patterns. Results indicate that both community type and season significantly influenced density, but only community type greatly affected feeding. No evidence could be found that long-term differences in rainfall levels affected densities, and water availability appeared to have no affect on feeding dispersion. The importance of community types ap-

pears to be related primarily to predation pressure, a factor now considered of increasing importance in wildlife management practices. (Tickes-Arizona)
W79-06835

THE MORPHOGENESIS OF IRANIAN CITIES,
Arizona Univ., Tucson. Dept. of Oriental Studies.
M. E. Bonine.
Annals of the Association of American Geographers, Vol. 69, No. 2, p 208-224, June 1979. 16 fig, 1 tab, 56 ref.

Descriptors: *Iran, *Regional development, *Urban hydrology, *City planning, *Distribution systems, *Irrigation canals, Planning, Regional analysis, Water resources development, Networks, Urban mapping, Community development, Drainage systems, Institutions, Institutional constraints, History, Irrigation systems, Open channels, Water conveyance.

It is this author's belief that in Iran an orthogonal network of streets exists in traditional Iranian cities which do not conform to a maze of irregular lanes built around rectangular religious building to facilitate maximum seasonal use but rather are the result of building to accommodate irrigation systems. The development of grid systems of main streets are described and illustrated in several Iranian cities which were constructed during the pre-industrial Iranian economy and rationally established in conjunction with systems of channels used to irrigate agricultural land. Accordingly, the orientation of the resulting orthogonal networks was determined by the need to arrange the rectangular fields and orchards to the slope of the land, and future housing construction was governed by the pre-existing system of fields and passageways. Irrigation and agricultural practices, then, have played an overriding role in the establishment of the morphology of traditional Iranian cities and expansion has been along existing streets and water channels. (Tickes-Arizona)
W79-06842

7. RESOURCES DATA

7A. Network Design

UTILIZATION AND INTERPRETATION OF HYDROLOGIC DATA WITH SELECTED EXAMPLES FROM NEW HAMPSHIRE,
New Hampshire Univ., Durham. Water Resource Research Center.
F. R. Hall, and S. L. Dingman.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-295 393, Price codes: A06 in paper copy, A01 in microfiche. Research Report No. 20, 1979. 92 p, 20 fig, 11 tab, 29 ref. OWRT A-040-NH (2), 14-31-0001-4029.

Descriptors: *Hydrologic data, *Flow-duration curves, Data analysis, *Regression analysis, Flow rates, Streamflow, Statistical methods, Flood frequency, Low flows, New Hampshire.

The modern emphasis on comprehensive planning and environmental studies has created a increasing demand for the interpretation and utilization of hydrologic data. A potential user of such data is faced with at least three kinds of problems: (1) Availability of data and adequacy of data collection programs; (2) What to do with the data that are available; and (3) How to transfer available data from a collection site to an unmeasured location of interest. This report focuses on interpretation and utilization of available data. The examples are drawn from streamflow records. The general plan of the report is to give examples of various ways of manipulating and interpreting streamflow data. First, there is a discussion of data sources and useful works available in the hydrology literature. This is followed by a section which deals with the basic elements of frequency analysis. Then there is a more detailed description of how to synthesize flow duration curves for ungaged areas. This is followed by a section which has an application of a regional flood analysis, mainly by graphical methods. The report is concluded with selected examples of the use of regression analysis.
W79-06502

NONPOINT SOURCE SAMPLING DESIGN REPORT AREAWIDE WASTE TREATMENT MANAGEMENT PLAN FOR THE GREATER HOUSTON AREA.
Dannenbaum Engineering Corp., Houston, TX.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-277 758, Price codes: A06 in paper copy, A01 in microfiche. Final Report, 1977. 113 p, 27 tab, 3 ref, 3 append.

Descriptors: Texas, Cities, *Water pollution sources, *On-site data collections, *Data storage and retrieval, Water quality, *Monitoring, Land use, Watersheds(Basins).

A procedure was developed for the establishment of a sampling program and resulting data base for the characterization of non-point sources of water pollution within the Greater Houston 208 planning area. Currently active water quality monitoring programs were reviewed and found to yield insufficient data on non-point sources due primarily to the nonhomogeneousness of the upstream contributory watersheds. Only intensive, event-type sampling can be effective in non-point pollutant identification and quantification. Also, the development of acceptable land use water quality relationships is necessary. (Small-FIRL)
W79-06569

GROUNDWATER DATA COLLECTION IN THE WATER DATA UNIT,
Her Majesty's Stationery Office, London (England). Archive Section.
For primary bibliographic entry see Field 7C.
W79-06792

LANDFILL CELL DESIGNED FOR HAZARDOUS WASTE DISPOSAL,
Florida State Dept. of Public Works, Jacksonville. Sanitation Div.
For primary bibliographic entry see Field 5G.
W79-06863

GROUND-WATER COMPUTER MODELS - INTELLECTUAL TOYS,
For primary bibliographic entry see Field 7C.
W79-06907

7B. Data Acquisition

IDENTIFICATION OF CONTAMINANTS IN LAKE SUPERIOR THROUGH LANDSAT I DATA,
Minnesota Univ.-Duluth. Dept. of Physics.
For primary bibliographic entry see Field 5A.
W79-06600

TO MARK SAMPLING EVENTS ON A RUNOFF HYDROGRAPH,
Maryland Univ., College Park. Dept. of Agricultural Engineering.
A. T. Johnson, R. Kort, and J. E. Ayars.
Agricultural Engineering, Vol. 59, No. 9, p 22-23, September, 1978. 2 fig.

Descriptors: *Runoff, *Hydrographs, Intermittent streams, Instrumentation, Stream gages.

A Stevens Type F Water Stage Recorder can be modified to make it more practical for runoff studies and to monitor streams where flow is intermittent. The modification is described. (Skogerboe-Colorado State)
W79-06697

THE USE OF LANDSAT DCS AND IMAGERY IN RESERVOIR MANAGEMENT AND OPERATION,
Army Engineer District, Waltham, MA. New England Div.
For primary bibliographic entry see Field 4A.
W79-06762

SNOW SURVEY AND VEGETATION GROWTH IN THE SWISS ALPS,
Zurich Univ. (Switzerland). Dept. of Geography.
H. Haefner.
Available from the National Technical Information Service, Springfield, VA 22161 as N76-25626, Price codes: A03 in paper copy, A01 in microfiche. Final Report of Swiss EREP-Project No. 323, December 1975. 38 p, 18 fig, 5 ref.

Descriptors: *Remote sensing, *Snow cover, *Vegetation, Satellites(Artificial), Data processing, Snow, Snow surveys, Analytical techniques, Mapping, Classification, Mountains, Alpine, *Swiss Alps, *Switzerland.

Analog processing of S-190-A and B color and IR-color transparencies showed that it is possible to evaluate the courses of the temporary snow line and the upper limit of vegetation growth over large areas. By transferring the results from S-190-A onto a topo-map 1:200,000, an accuracy of + or - 50 m could be achieved. With S-190-B transferred onto a map 1:100,000, an accuracy of + or - 20 m was reached. A compilation of the altitudinal position of these boundaries in different regions, exposures, etc. showed very significant variations for a specific date (September 11, 1973). The upper limit of vegetation growth oscillates between 2,000 and 3,100 m, while the difference between upper boundary of vegetation growth and snow line varies from 450 to 900 m. No comparative synoptic regional data of such kind was available until now. Digital processing of S-192 multispectral data allowed a separation of snow and clouds by combining the information from channels 9 (0.78 - 0.88 micrometer), 15 (1.55 - 1.75 micrometer) and 18 (0.46 - 0.51 micrometer). The developed processing sequence included preprocessing steps, feature extraction, and data output in form of a maplike image of a selected scale with a photomation system. The classification procedure is supervised, based on euclidean distances. (Sims-ISWS)
W79-06764

INORGANIC POLLUTION IN WATER--THE ANALYST'S VIEWPOINT,
Geological Survey, Denver, CO. Water Resources Div.
M. W. Skougstad, and M. J. Fishman.
Toxicological and Environmental Chemistry Reviews, Vol. 2, p 219-236, 1978. 7 fig, 7 tab.

Descriptors: *Water pollution, *Inorganic compounds. *Water analysis, *Chemical analysis, *Analytical techniques, Instrumentation, Laboratory tests, Trace elements, Heavy metals, *Data reliability, *Standard reference water samples.

Inorganic pollution comprises both major and minor constituents, although only 12 chemical elements may be considered major components. Twenty-eight elements constitute a group of common minor elements and an additional 13 elements comprise a group of less common minor constituents. Reliable quantitative data are required on the occurrence of these substances in a wide variety of water types, usually at extremely low concentrations. The analysis of standard reference water samples provides information on the overall reliability of water-quality data. Although most major constituents may be determined with acceptable reliability, determinations of certain minor constituents lack comparable precision; for example, determinations of boron, nickel, and chromium. Few precision data are available on the determination of the less common trace elements. Several comparatively new analytical techniques, such as flameless atomic absorption spectrophotometry, voltammetry, and emission spectroscopy with plasma excitation, appear capable of providing improved sensitivity. (Woodard-USGS)
W79-06821

ON THE APPROXIMATION OF SATURATION VAPOR PRESSURE,
Geological Survey, Tacoma, WA. Water Resources Div.
L. A. Rasmussen.
Journal of Applied Meteorology, Vol 17, No 10, p 1564-1565, October 1978. 1 tab, 4 ref.

Descriptors: *Vapor pressure, *Saturation, *Thermal properties, *Meteorology, *Model studies, Analytical techniques, Numerical analysis, Atmospheric physics, Equations, Evaluation.

The saturation vapor pressure of water vapor in the atmosphere is an important variable in many meteorological processes. Numerical approximation of the dependence of this variable on temperature is necessary in the modeling of these processes. Given here are the coefficients of eight approximating functions, five polynomials and three rational functions, for the saturation pressure with respect to a liquid water surface for the temperature intervals (-50C, +50C) and (0C, +50C), and with respect to an ice surface for the interval (-50C, 0C). Considering both the required computation time and the resulting error, these functions compare favorably with others published recently. (Woodard-USGS)
W79-06826

SATELLITE SURVEILLANCE OF PHYSICAL WATER-QUALITY CHARACTERISTICS,
Geological Survey, Sioux Falls, SD. Water Resources Div.
G. K. Moore.
In: Proceedings of the Twelfth International Symposium on Remote Sensing of Environment, Ann Arbor, Michigan, April 20-26, 1978, p 445-462, 1978. 10 fig, 2 tab, 15 ref.

Descriptors: *Remote sensing, *Surface waters, *Turbidity, *Color, *Satellites(Artificial), Infrared radiation, Solar radiation, Atmosphere, Light penetration, Particle size, Suspended load, Bottom-reflected light, Spectroscopy, *Landsat images, *Solar flux, *Energy backscatter, Specular reflection.

Remote sensing instruments obtain an optical measure of water color and turbidity. Color increases the absorption of light in water and decreases the remote signal; turbidity increases the backscatter of light. Satellite surveillance of water turbidity presently is evaluated as a costly way of obtaining information, but several potential applications may be economical. These include the use of turbidity as an index to streamflow velocity and to the productivity of lakes, estuaries, and oceanic fishing grounds. (Woodard-USGS)
W79-06829

PRACTICAL METHODS OF AIMING ANTENNAS AT GEOSTATIONARY SATELLITES,
Department of Fisheries and Environment, Ottawa (Ontario). Inland Waters Directorate.
I. A. Reid.
Technical Bulletin No 104, 1978, 10 p, 7 fig, 4 ref.

Descriptors: *Satellites(Artificial), *Data transmission, *Data collections, *Hydrometry, *Geostationary Operational Environmental System(GOES), *Antennas, Hydrometeorology, Sensors.

The procedure for aligning Data Collection Platform (DCP) antennas in the Geostationary Operational Environmental Satellite (GOES) System is presented. A method is given for determining (a) the angle of elevation and (b) the azimuth or bearing, to which an antenna must be set to bring it in line with a satellite. Two detailed methods, one using a compass and the other a watch, are presented for setting an antenna on the predetermined bearing. (WATDOC)
W79-06851

STREAM NETWORK ANALYSIS AND GEOMORPHIC FLOOD PLAIN MAPPING FROM ORBITAL AND SUBORBITAL REMOTE SENSING IMAGERY APPLICATION TO FLOOD HAZARD STUDIES IN CENTRAL TEXAS,
Texas Univ. at Austin. Dept. of Geological Sciences.
V. R. Baker, R. K. Holz, S. D. Hulke, P. C. Patton, and M. M. Penteado.
Available from the National Technical Information Service, Springfield, VA 22161 as N75-30620, Price codes: A09 in paper copy, A01 in microfiche. Final Report, EREP No. 064B, April 30, 1975. 196 p, 72 fig, 10 tab, 127 ref. NASA 9-13312.

Descriptors: *Remote sensing, *Floods, *Texas, Satellites(Artificial), Aircraft, Watersheds(Basins), Streams, Drainage, Mapping, Flood peak, Hazards, Topography, Topographic mapping, Geomorphology, Climatology, Hydrology, Skylab.

Flood hazard evaluation can be approached from two viewpoints. An 'upstream' approach would consist of evaluating the interaction of rainfall inputs and physiographic factors in producing flood responses on small watersheds. A 'downstream' approach would map flood hazard zones in the broad alluvial valleys which rivers develop after collecting the flow of numerous tributaries. In this report, an attempt was made to apply remote sensing imagery to both aspects of the flood hazard evaluation problem. This report has two general parts. The first part concerns upstream controls through a discussion of the adjustment of stream network geometry to climatic and geologic factors. The second part of the report concerns downstream flood problems through a discussion of floodplain mapping techniques. (Sims-ISWS)
W79-06877

EFFECT OF HAZARDOUS MATERIAL SPILLS ON BIOLOGICAL TREATMENT PROCESSES,
Environmental Quality Systems, Inc., Rockville, MD.
A. P. Pajak, E. J. Martin, G. A. Brinsko, and E. J. Erny.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-276 724, Price codes: A10 in paper copy, A01 in microfiche. Report EPA-600/2-77-239, 1977. 200 p, 1 fig, 4 tab, 78 ref.

Descriptors: *Biological treatment, *Activated sludge, *Chemicals, *Water pollution effects, *Industrial wastes, Biodegradation, Waste water treatment, Chemical wastes.

A method has been developed for evaluating the effects of various chemical substances on biological waste water treatment processes. The analysis utilizes a matrix format where more than 250 chemicals are listed alphabetically. Data listed in the matrix for each chemical substance include: a description of the chemical substance; its effect on the treatment process parameters, especially the activated sludge process; and the effects of the treatment process on the chemical substance. Data and results from bench scale, pilot plant, and full scale studies are also supplied. The matrix is arranged in a format that is suitable for its use as an operations handbook. (Lisk-FRC)
W79-07000

7C. Evaluation, Processing and Publication

STORM RUNOFF MICROBIOLOGY ADDS TO CONCERNS,
Ontario Ministry of the Environment, Rexdale.
For primary bibliographic entry see Field 5B.
W79-06590

PROGRAMMING A POCKET CALCULATOR FOR SOLVING MULTIPLE WELL, VARIABLE PUMPING RATE PROBLEMS,
Stone and Webster Engineering Corp., Boston, MA.
L. W. Picking.
Ground Water, Vol 17, No 2, p 205-208, March-April 1979. 2 fig, 1 tab.

Descriptors: *Groundwater, *Computer programs, *Theis equation, *Computers, Water wells, Pumping, Equations, Mathematical studies, Mathematics, Wells, Pocket calculators, Multiple wells, Variable pumpage, Image well theory, Superposition.

Several of the newer models of programmable pocket calculators can accept programs that permit them to rapidly and accurately solve the Theis converging series formula. By freeing the Theis equation from the W sub (u) reference table, multiple well, variable pumping rate programs can be designed for operation on a simple input-output basis, using additive drawdown and image well theory. (Visocky-ISWS)
W79-06593

CHANGING PATTERNS OF GROUND-WATER USE IN THE UNITED STATES,
NSF Science for Citizens Program, Madison, WI.
A. Zaporozec.
Ground Water, Vol 17, No 2, p 199-204, March-April 1979. 5 fig, 2 tab, 7 ref. NSF OSS 77-23964.

Descriptors: *Water utilization, *United States, *Water resources, *Data collections, Groundwater, Water supply, Rural areas, Irrigation water, Surface waters, Municipal water.

The increasing use of groundwater and its true role as a source of water supplies in the United States have sometimes been interpreted incorrectly. The total use of groundwater has indeed increased tremendously during the last 20 years (by almost 80%), but so has the total use of water (over 70%). And groundwater is still far from being a primary source of water supplies. In 1975, only 20% of the total amount of water withdrawn in the United States for various uses came from groundwater sources. Statistical analysis of groundwater data for the period 1950-1975 has shown that the groundwater usage is changing only very slowly. Relation of groundwater use to total water use expressed in percent was used as an indicator of changes of groundwater use patterns. This percentage has not changed significantly, and it has fluctuated around 19%. In 1975, only 6 states used more groundwater than surface water for their water supplies, and in 23 states groundwater use was less than 10% of total use. Even more unfavorable is the magnitude of change in ratio of groundwater use relative to total water use. From 1955 to 1975, only 13 states show an increase in the ratio. In 28 states the ratio has decreased, and in 7 it has remained the same. (Humphreys-ISWS)
W79-06594

GROUND-WATER COMPUTER MODELS--STATE OF THE ART,
Camp, Dresser and McKee, Inc., Champaign, IL. Water Resources Div.
For primary bibliographic entry see Field 2F.
W79-06595

RELATIONSHIPS BETWEEN CONCENTRATIONS AND DISCHARGE ON SELECTED ILLINOIS STREAMS,
Northern Illinois Univ., DeKalb. Dept. of Geology.
For primary bibliographic entry see Field 5B.
W79-06737

ANALYTICAL STUDY OF THE OGALLALA AQUIFER IN GAINES COUNTY, TEXAS, PROJECTIONS OF SATURATED THICKNESS, VOLUME OF WATER IN STORAGE, PUMPAGE RATES, PUMPING LIFTS, AND WELL YIELDS,
Texas Dept. of Water Resources, Austin.
A. E. Bell, and S. Morrison.
Report 227, March 1979. 68 p, 18 tab, 72 ref, 24 map.

Descriptors: *Groundwater resources, *Texas, *Aquifers, *Data collections, Groundwater, Maps, Water resources, Aquifer characteristics, Groundwater recharge, Water supply, Groundwater availability, Groundwater mining, Overdraft, Pumping,

Projections, Saturated flow, *Gaines County(TX), *Ogallala aquifer(TX), Pumpage rates, Pumping lifts, Well yields.

This is one numerous planned county studies covering the declining groundwater resource of the Ogallala aquifer in the High Plains of Texas. The report contained maps, charts, and tabulations which reflect estimates of the volume of water storage in the Ogallala aquifer in Gaines County and the projected depletion of this water supply by decade periods through the year 2020. The report also contained estimates of pumpage, pumping lifts, and other data related to current and future water use in the county. However, the report did not attempt to project that portion of the volume of water in underground storage which may be ultimately recoverable. The Ogallala aquifer in Gaines County contained approximately 9.9 million acre-feet of water in 1974. Historical pumpage has exceeded 200,000 acre-feet annually, which is more than twice the rate of natural recharge to the aquifer in the county. This overdraft is expected to continue, ultimately resulting in reduced well yields, reduced acreage irrigated, and reduced agricultural production. There is a very uneven distribution of groundwater in the county. Some areas have ample groundwater resources to support current usage through the year 2000; whereas, in other areas, groundwater is currently in short supply. To obtain maximum benefits from the remaining groundwater resources, water users should implement all possible conservation measures so that the remaining groundwater supply is used in the most prudent manner possible and with the least amount of waste. (Humphreys-ISWS)
W79-06738

MORPHOLOGY AND WATER REGIME OF A DOTHAN SOIL,
Soil Conservation Service, Auburn, AL.
For primary bibliographic entry see Field 2F.
W79-06742

PUBLIC GROUNDWATER SUPPLIES IN MORGAN AND SCOTT COUNTIES,
Illinois State Water Survey, Urbana.
D. M. Woller, and E. W. Sanderson.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-295 724, Price codes: A02 in paper copy, A01 in microfiche. ISWS Bulletin 60-27, 1979. 20 p, 1 fig.

Descriptors: *Water supply, *Illinois, *Groundwater resources, Unconsolidated aquifers, Well data, Gravels, Sand aquifers, Bedrock, Sandstones, Groundwater availability, Groundwater, Hydrology, Hydrogeology, Water sources, Water quality, Water wells, Municipal water, Water yield, Water properties, Hardness(Water), Chemical properties, Deep wells, Shallow wells, Geology, Aquifers, *Morgan County(IL), *Scott County(IL), Dissolved minerals, Water bearing formations.

All available information on production wells used for public water supplies in Morgan and Scott Counties, Illinois, was presented. The definition of public water supply as contained in the Environmental Protection Act of 1970 was used to determine those water systems and wells to be included. The report included separate descriptions for 7 public water supply systems furnishing water to 10 municipalities, 3 state institutions, and 1 water commission. These were preceded by brief summaries of the groundwater geology of the county and the development of groundwater sources for public use. Individual production wells for each supply were described in the order of their construction. The description for each well included the aquifer tapped, date drilled, depth, driller, legal location, elevation in feet above mean sea level, log, construction features, yield, pumping equipment, and chemical analyses. (Humphreys-ISWS)
W79-06768

PUBLIC GROUNDWATER SUPPLIES IN PIKE COUNTY,
Illinois State Water Survey, Urbana.
D. M. Woller, K. L. Kunz, and E. W. Sanderson.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-295 977, Price codes: A02 in paper copy, A01 in microfiche. ISWS Bulletin 60-26, 1979. 20 p, 1 fig.

Descriptors: *Water supply, *Illinois, *Groundwater resources, Unconsolidated aquifers, Well data, Gravels, Sand aquifers, Bedrock, Sandstones, Groundwater availability, Groundwater, Hydrology, Hydrogeology, Water sources, Water quality, Water wells, Municipal water, Water yield, Water properties, Hardness(Water), Chemical properties, Deep wells, Shallow wells, Geology, Aquifers, *Pike County(IL), Dissolved minerals, Water bearing formations.

All available information on production wells used for public groundwater supplies in Pike County, Illinois, was presented. The definition of public water supply as contained in the Environmental Protection Act of 1970 was used to determine those water systems and wells to be included. The report included separate descriptions for groundwater supplies of 11 municipalities in Pike County. These were preceded by brief summaries of the groundwater geology of the county and the development of groundwater sources for public use. Individual production wells for each supply were described in the order of their construction. The description for each well includes the aquifer tapped, date drilled, depth, driller, legal location, elevation in feet above mean sea level, log, construction features, yield, pumping equipment, and chemical analyses. (Humphreys-ISWS)
W79-06769

GROUNDWATER DATA COLLECTION IN THE WATER DATA UNIT,
Her Majesty's Stationery Office, London (England). Archive Section.
M. L. Lees.
Water Services, Vol. 83, No. 997, p 180-185, March, 1979. 4 tab, 10 ref.

Descriptors: *Great Britain, *Data collections, *Groundwater, *Data storage and retrieval, Aquifers, Water levels, Water quality, Hydrographs, Hydrologic data, Weather data, Statistics, Water utilization, Water supply, Computers, Documentation, Publications, Observation wells, Water level recorders.

Statistics on the increasing use of groundwater for public supplies in England and Wales are presented in tabular form. The principal aquifers and their contribution to the total ground water supply are listed. The Chalk, Lower Greensland and the Triassic sandstones are the most important aquifers. In general, the older geologic systems have limited ground water potential. In many areas aquifers may be developed for local supplies. Groundwater data collection using a network of observation wells with automatic water level recorders began after passage of the Water Resources Act of 1963. The Water Data Unit processes the data into a computer and based storage system. The data is published periodically in Ground Water: United Kingdom, Ground Water Year Book, and Water Data. Examples are presented of groundwater hydrographs which are available from the Water Data Unit Archives. Other retrievals are available as printed tables. At present, there is no central system for collecting a digest of chemical and bacteriological analyses of groundwater in England and Wales. If this data is incorporated into the computer-based storage system, compositional maps of groundwater can be produced. (Purdin-NWWA)
W79-06792

GROUND-WATER QUALITY IN BANNOCK, BEAR LAKE, CARIBOU, AND PART OF POWER COUNTIES, SOUTHEASTERN IDAHO,
Geological Survey, Boise, ID. Water Resources Div.
H. R. Seitz, and R. F. Norvitch.
Geological Survey Water-Resources Investigations 79-14 (open-file report), February 1979. 53 p, 1 fig, 2 tab, 27 ref.

Descriptors: *Water quality, *Groundwater, Water chemistry, *Groundwater movement, *Geochemistry, Water pollution, Salinity, Aquifers, Water wells, Water analysis, Chemical analysis, Dissolved solids, Nitrogen, Chlorides, Hardness(Water), Well data, Groundwater recharge, Water table, Water treatment, Sampling, Standards, Irrigation water, Idaho, *Bear Lake Valley, *Marsh Valley, *Portneuf Valley, *Gem Valley.

The 103 wells sampled during the study establish a quasi-network that could be resampled in the future to document and analyze changes in ground-water quality in the southeastern Idaho study area. The main aquifers are categorized as alluvium of Quaternary age, basalt of Quaternary and (or) Tertiary age, rocks of the Salt Lake Formation of Tertiary age, and undifferentiated bedrock of pre-Tertiary age. Dissolved solids, hardness, nitrite plus nitrate as nitrogen, and chloride concentrations in the ground waters ranged from 165 to 1,690; 78 to 1,700; 0 to 29; and 1.9 to 360 milligrams per liter, respectively. The areal distributions of these constituents are shown on maps. The range and median values of these same constituents are tabulated by aquifer occurrence. Some of the most mineralized and hardest waters occur in the basalt aquifer near travertine deposits (or terraces), which are composed of calcium carbonate precipitates from mineral springs. For irrigation purposes, all the waters are classified as having low-sodium hazard. Most have medium- to high-salinity hazard. (Woodard-USGS)
W79-06814

WATER-RESOURCES INVESTIGATIONS IN FLORIDA, 1977,
Geological Survey, Tallahassee, FL. Water Resources Div.
Geological Survey Water-Resources Investigations in Florida folder, 1978. 1 sheet.

Descriptors: *Water resources, *Projects, *Florida, *Water quality, Surface waters, Groundwater, Data collections, Sites, Maps, Bibliographies, Publications.

The folder describes past and present water-resources investigations in Florida conducted by the U.S. Geological Survey in cooperation with the Florida Department of Environmental Regulation and other State, municipal, and Federal agencies. Included are: (1) A large map of the State that shows the location of over 425 surface-water sites where streamflow and water-quality data are collected, (2) sites where groundwater-level data are collected, and (3) the location of 48 USGS water-research projects currently under investigation. The folder lists more than 360 water-resources reports and maps. (Woodard-USGS)
W79-06822

WETLAND CLASSIFICATION SYSTEM FOR THE TENNESSEE VALLEY REGION,
Geological Survey, Reston, VA. Water Resources Div.; and Tennessee Valley Authority, Norris, TN. Div. of Forestry, Fisheries, and Wildlife Development.
V. Carter, and J. H. Burbank.
Tennessee Valley Authority Technical Note No. B24, June 1978. 36 p, 14 fig, 2 tab, 29 ref.

Descriptors: *Wetlands, *Classification, *Vegetation, *Methodology, *Tennessee Valley Authority, Hydrologic budget, Management, *Tennessee Valley region.

A wetland classification system for the Tennessee Valley region is described. The wetland classes and subclasses are based on vegetation and frequency and duration of inundation. There are 6 wetland classes and 12 wetland subclasses. This system is compared with other existing classification systems. (Woodard-USGS)
W79-06823

THE OCCURRENCE, AVAILABILITY, AND CHEMICAL QUALITY OF GROUND WATER,

GRAND STRAND AREA AND SURROUNDING PARTS OF HORRY AND GEORGETOWN COUNTIES, SOUTH CAROLINA,
Geological Survey, Columbia, SC. Water Resources Div.
A. Zack.
South Carolina Water Resources Commission Report No. 8, 1977. 100 p, 33 fig, 5 tab, 19 ref.

Descriptors: *Groundwater resources, *Groundwater availability, *Water quality, *Aquifer characteristics, *Geologic formations, Water wells, Water yield, Water levels, Hydrogeology, Groundwater movement, Saline water intrusion, Groundwater recharge, Specific capacity, Chemical analysis, Aquifer management, South Carolina, *Horry County, *Georgetown County.

An evaluation of developing water-well and water-quality problems in the coastal aquifer systems of Horry and Georgetown Counties, S.C., was initiated in 1972. Geologic cross sections detail the stratigraphic relationships of sand, clay, and calcareous sandstone and also establish formational boundaries between Tertiary formations boundaries between Tertiary formations and the Peedee, Black Creek, and Middendorf Formations. The Black Creek aquifer system is the most satisfactory source of good-quality water in the two-county area. Usually the water is soft, low in chloride, and iron- and sulfate-free. However, fluoride concentrations are excessive, reaching 5.5 milligrams per liter in some areas. Water in the Peedee Formation and Tertiary formations, although low in fluoride and chloride, often contains excessive concentrations of iron, hydrogen sulfide, and sulfate. Treatment would be necessary before this water could be considered for a domestic water supply. Water in the Middendorf Formation is salty presumably throughout the two-county area. A typical value of the hydraulic conductivity of Black Creek sand beds is 30 feet per day, but it is less in central and southern Geogetown County. An average value of specific storage of 0.0000026 per foot has been calculated from pumping tests throughout the area. (Woodard-USGS)
W79-06831

METHANE MIGRATION AROUND SANITARY LANDFILLS,
Ohio State Univ., Columbus. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5B.
W79-06843

LOCATION OF MUNICIPAL WELL FIELDS IN AN ENVIRONMENTALLY SENSITIVE REGION,
Geraghty and Miller, Inc., Tampa, FL.
For primary bibliographic entry see Field 6B.
W79-06855

SOME PROBLEMS IN EVALUATING THE ABILITY OF STRATA TO STORE OR TRANSMIT POLLUTANTS,
Manchester Univ. (England). Dept. of Civil and Structural Engineering.
For primary bibliographic entry see Field 5B.
W79-06862

IMPACT OF WASTES FROM A WATER TREATMENT PLANT: EVALUATIVE PROCEDURES AND RESULTS,
Illinois State Water Survey, Urbana.
For primary bibliographic entry see Field 5E.
W79-06889

GROUNDWATER LEVELS AND PUMPAGE IN THE EAST ST. LOUIS AREA, ILLINOIS, 1972-1977,
Illinois State Water Survey, Urbana.
For primary bibliographic entry see Field 2F.
W79-06890

GROUND-WATER COMPUTER MODELS - INTELLECTUAL TOYS,
H. A. Baski.
Ground Water, Vol. 17, No. 2, p 177-179, March-April, 1979.

Descriptors: *Computer models, *Hydrogeology, *Projections, Computer programs, Ground water, Aquifer characteristics, Model studies, Basic data collections.

Misuse of ground water computer models through misapplication, oversell, and questionable methods may destroy confidence in them both outside and within the ground water profession. Ground water computer models can be useful tools for making projections using aquifer and confining bed characteristics as input. For short-term projections, transmissivity is the key item. However, for long-term projections recharge and storage coefficient become more important. The degree of uncertainty in the input will determine the accuracy of the output. Other types of models that can be used for projections include flow nets, well formulas, heat flow formulas, and extrapolations. Regardless, of what model is used, the collection and interpretation of good basic data is of the utmost importance for accurate projections. (Purdin-NWWA)
W79-06907

GROUND-WATER COMPUTER MODELS - PRACTICAL TOOLS,
Wright Water Engineers, Inc., Denver, CO. Ground Water Div.
R. E. Darr.
Ground Water, Vol. 17, No. 2, p 174-175, March-April, 1979. 9 ref.

Descriptors: *Groundwater, *Computer models, *Water management(Applied), *Hydrogeology, Computer programs, Computers, Wellfields, Conjunctive use, Solutes, Statistical models, Calculators.

Models that can be programmed on computers or hand-held calculators are valuable and practical tools for the ground water manager in solving complex problems for wellfields, conjunctive use, solute transport, and statistics. The digital computer, the analog, and hybrid computers have been used very effectively for hydrogeologic models. A valid model must conform to the law of mass balance (i.e., the water in must equal the water out plus the water stored) and Darcy's Law. Computer models are most useful where there is a lack of data and a quick approximation is needed. They vary in complexity and cost depending on the type of problem and the degree of accuracy required. The practicality of such models and their results is a function of the intelligence of the user. Models are only time-saving tools which require data collection, practical human experience, judgment evaluations and common sense to program and interpret. (Purdin-NWWA)
W79-06908

DATA MANAGEMENT SYSTEM (DMS) FOR TIME SERIES,
Hydrocomp Inc., Palo Alto, CA.
J. J. Heler.
Transactions of the ASAE, Vol. 22, No. 1, p 122-125, Jan.-Feb. 1979. 5 fig.

Descriptors: *Data management, *Time series, Hydrologic data, Meteorological data, Data organization, Data compression, System mode, System operation, Capabilities, Systems analysis, Computer programs.

Agencies which collect hydrometeorological or related information find that the volume of data increases rapidly. Also, new techniques in hydrologic and water quality analysis are being developed, and these require more kinds of data and create greater problems in management. Modern analytical methods are computer based; thus it is desirable to have a data retrieval system within the same software to allow direct transfer of information. Hydrocomp Inc. has developed a data management system as part of the modernization and improvement of its analysis tools. This system is a component of a new release of Hydrocomp simulation software called Hydrocomp Simulation Processor II (HSPII). This paper describes Data Management System (DMS) capabilities. In addition to storing and retrieving a considerable amount of information collected as time series, the system can be used to perform a variety of analyses on transformations of these data and print out in tabular or graphical form the original data series or its transformation. DMS is suitable to a wide variety of applications; it can store and process any data collected as a sequence in time. It is a useful analytical tool presented for agencies who are considering a conversion to modern computer-based data management. (Bell Graf-Cornell)
W79-06928

8. ENGINEERING WORKS

8A. Structures

SEWER SYSTEM EVALUATION, REHABILITATION AND NEW CONSTRUCTION A MANUAL OF PRACTICE,
American Public Works Association, Chicago, IL.
R. H. Sullivan, M. M. Cohn, T. J. Clark, W. Thompson, and J. Zaffle.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-279 248, Price codes: A09 in paper copy, A01 in microfiche. Report EPA-600/2-77-017d, 1977. 117 p, 23 fig, 13 tab, 4 ref, 6 append.

Descriptors: *Infiltration, *Sewers, *Sewerage, Design, *Evaluation, Inspection, *Rehabilitation, Costs, Waste water, Design standards.

This manual discusses three areas of infiltration/inflow of sewer systems: sewer system evaluation, sewer rehabilitation, and design of new systems to minimize infiltration/inflow. Procedures for conducting the System Analysis and Sewer System Evaluation (SSES) by local authorities and consulting engineers are described in detail. Methods of sewer inspection and sewer cleaning equipment are discussed, and cost factors are given. Rehabilitation techniques are described. Establishment of infiltration limits for new sewer construction is recommended at a rate not to exceed 20 gal/inch diameter/mile/day. Testing for infiltration limits is described. (Small-FIRL)
W79-06506

SUBSURFACE WASTE-HEAT STORAGE: EXPERIMENTAL STUDY,
Auburn Univ., AL. Water Resources Research Inst.
J. C. Warman, F. J. Molz, and T. E. Jones.
Available from the National Technical Information Service, Springfield, VA 22161 as ORO-5003-1, Price codes: A02 in paper copy, A01 in microfiche. Final Report No. ORO/5003-1, June 30, 1977. 67 p, 7 fig, 1 tab, 23 ref, 1 append. E-(40-1)-5003.

Descriptors: *Waste storage, *Heat, *Injection wells, Hydraulics, Heat transfer, Instrumentation, On-site investigations, On-site tests, Wells, Well data, Well spacing, Drilling, Pumping, Porosity, Thermal conductivity, Porous media, Porosity, Water utilization.

Confined aquifers are used as storage reservoirs for moderate to high temperature water in proposed electrical power plant and solar heating systems. An experimental program was undertaken to test the heat storage well concept and to provide data for the calibration of mathematical models. The experimental program was in four phases. In Phase I an exploratory well was drilled at the selected field site. Construction of the central injection well and three observation wells took place during Phase II as well as preliminary pumping tests. During Phase III the remainder of the observation well field was constructed, final pumping tests were performed, and the measurement of aquifer thermal properties were taken. Phase IV involved a cycle of warm water injection, storage and recovery. It is concluded that: heat storage aquifers need low natural pore velocities; require the use of heated water with low suspended solids, or clog-

ging will become a serious problem; the swelling of clays must be minimized; hydraulic pressures capable of breaching the confining layers must be avoided; and the use of formation water as influent to the heating system may minimize clogging problems. The calculated energy recovery factor of 0.68 on storage of two million gallons for 36 days was considered promising. (Davison-IPA)
W79-06565

TRANSIENT SEEPAGE ANALYSIS OF GURI DAM,
Harza Engineering Co., Chicago, IL. Hydrology Analysis and Design Div.
C-Y. Wei, and W. Y. J. Shieh.
Journal of the Technical Councils, American Society of Civil Engineers, Vol 105, No TCl, Proceedings Paper 14503, p 135-147, April 1979. 8 fig, 1 tab, 14 ref, 1 append.

Descriptors: *Dams, *South America, *Earth dams, *Seepage, *Model studies, Mathematical models, Finite element analysis, Soil water, Hydraulic conductivity, Porous media, Soil water movement, Saturated soils, Pore water, Pore pressure, Reservoirs, Dam design, *Venezuela, *Guri Dam(Venezuela).

The transient seepage analysis of the 95-m high Guri earthfill dam was undertaken to investigate the saturation of earthfill and foundation during and after staged reservoir filling. Saturated-unsaturated porous media flow theory and Galerkin-type finite element techniques were applied. The phreatic surfaces were treated as zero pore pressure lines. The zero pore pressure line was obtained from the calculated pore pressures, including negative pressures in partially saturated zones. The movements of the saturation (wetting) fronts and the pore pressure distributions in the earthfill and its foundation were used in the investigation of deformation and stability of the Guri earthfill dam under staged construction and reservoir filling. (Sims-ISWS)
W79-06587

BOTSWANA AND MALAWI RURAL WATER SUPPLIE.
Water Services, Vol. 82, No. 993, p 784, 786, November, 1978.

Descriptors: *Botswana, *Malawi, *Water supply development, Africa, *Rural areas, Diseases, Water distribution, Pipelines, Groundwater, Water wells.

About 80% of human and livestock water requirements in Botswana depend on ground water supplies. Under the British Aid Programme, 65,000 villagers will obtain water piped from existing wells. 30% of the wells were in need of maintenance and rehabilitation before pipelaying could begin. This water distribution system not only will reduce the spread of water-borne diseases through contaminated drinking water, but will save time and energy in carrying water that could be spent better in growing vegetables. The Malawi rural water supply project brings similar benefits but differs from the Botswana project in two ways. First, the water supply is gravity-fed from mountain streams and lakes. Secondly, the construction of the system is done entirely by groups of villagers. Local village leaders are taught to maintain the pipes, storage tanks, etc. (Purdin-NWWA)
W79-06724

REPORT OF COMMITTEE ON GROUND WATER SUPPLIES IN NEW ENGLAND.
For primary bibliographic entry see Field 5G.
W79-06735

EVALUATION OF TRENCHLESS SEWER CONSTRUCTION AT SOUTH BETHANY BEACH, DELAWARE,
Richardson (Edward H.) Associates, Inc., Newark, DE.
L. J. Beetschen, and W. C. Henry.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-278 776, Price codes: A05 in paper copy, A01 in microfiche. Report No. EPA-600/2-78-022, March 1978. 94 p, 35 fig, 20 tab. S-800690.

Descriptors: *Sewers, *Construction, *Construction costs, *Construction materials, *Construction joints, Soil types, Water table, Cost comparisons, Trenches, Installation costs, Construction costs, Pipes, Pipelines.

A trenchless method of sewer construction was compared with conventional construction methods under similar site conditions. Cost comparisons were made on the basis of contract prices, calculated composite sewer systems, and man-day rate. The trenchless method proved to be more cost effective: 50% on the actual unit bid price; 16% on complete sewer installation including manholes, wyes, laterals; and 23% on labor. The conventional method used eight inch polyvinyl chloride pipe and rubber gasketed joints; the trenchless method used 8-inch polyvinyl chloride solvent welded pipe. Although the trenchless method does not seem suited for urban areas with significant subsurface utilities, or where rock or boulders appear in high density, it is adapted to high water table areas, and its application is flexible over a wide range of varying soil conditions. With proper field control it results in less deflection and horizontal and vertical misalignment; its potential for infiltration is small. This method is safer than the conventional one, because open trenching is reduced to a minimum. It is less disruptive to traffic, and is an improvement in sediment runoff control and noise reduction. (Davison-IPA)
W79-06783

RESIDUAL STRENGTH TEST, PARAITINGA AND PARAIBUNA DAMS, BRAZIL,
Army Engineer Waterways Experiment Station, Vicksburg, MS. Soils and Pavement Lab.
F. C. Townsend, and P. A. Gilbert.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A032 896, Price codes: A03 in paper copy, A01 in microfiche. Miscellaneous Paper S-74-21, June 1974. 30 p, 16 fig, 2 tab, 1 append.

Descriptors: *Shear strength, *Soil properties, *Soil compaction, Laboratory tests, Soil mechanics, Dams, Stress, Foreign countries, Foreign research, Shear, *Paraitinga dam, *Paraibuna dam, *Brazil, Waterways experiment station.

Monotonic residual strength tests were conducted on micaceous material from Paraitinga and Paraibuna dams. The test program consisted of multistage annular shear tests on both loosely and densely compacted specimens from both dams under normal stresses of 1.1, 3.1, and 9.1 kg per sq cm. The test results showed that materials from the two dams are quite similar and can be classified as silty sands. The densities of the block samples from Paraitinga and Paraibuna dams were 88.6 and 92.6% maximum standard density from Harvard miniature compaction tests. (Singh-ISWS)
W79-06879

INVESTIGATION OF PLASTIC PIPE FOR USE BY THE CORPS OF ENGINEERS,
Construction Engineering Research Lab. (Army), Champaign, IL.
A. Smith.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A042 313, Price codes: A03 in paper copy, A01 in microfiche. Technical Report M-219, July 1977. 43 p, 4 fig, 13 tab, 12 ref, 4 append.

Descriptors: *Plastic pipes, *Pressure conduits, *Building codes, *Water hammer, Plumbing, Economics, Corrosion, Data collections, Water supply, Energy consumption, Drain-waste-vent.

This report presented the findings of a study of commercially available plastic pipe used for water distribution, plumbing, drain-waste-vent, and sewage systems. The study included a survey of military and civilian users of plastic pipe to determine acceptance, a review of model building codes and standards, and a testing program involving the making of joints under different conditions. Results of this study indicated that plastic pipe is an acceptable substitute for metallic pipe in many installations. Significant cost savings in both labor and material can be realized by using plastic pipes. The plastic pipes are available in a range of sizes and pressure ratings. Less energy is required in their production, and their corrosion resistance can produce additional cost savings. Good, serviceable joints can be made with proper use of the currently available methods. (Singh-ISWS)
W79-06880

THE ORGANIC DRILLING FLUID CONTROVERSY: PART I,
M. R. Richard.
Water Well Journal, Vol. 33, No. 4, p 66-71, 74, April 1979.

Descriptors: *Water wells, *Drilling fluids, *Water pollution, Bacteria, Polymers, Rotary drilling, Sampling, Public health, Water wells, Disinfection.

A case study is presented of a water well driller who used Revert, an organic polymer drilling fluid. Bacterial contamination of wells drilled with this fluid was noticed after drilling over 50 wells. Efforts to correct the situation met with little success. The driller, unable to meet financial obligations since most of the wells were not approved by the local board of Health, filed bankruptcy and brought suit against the UOP Johnson Division which manufactures Revert. The driller may bear some responsibility for the contamination since he used hole cuttings containing Revert as grouting material, a practice which would tend to favor continued bacterial growth. (See also W79-06898) (Purdin-NWWA)
W79-06897

THE ORGANIC DRILLING FLUID CONTROVERSY: PART II,
M. R. Richard.
Water Well Journal, Vol. 33, No. 5, p. 50-58, May, 1979.

Descriptors: *Water wells, *Drilling, *Drilling fluids, *Polymers, Water pollution, Rotary drilling, Bentonite, Well regulations, Public health, Sampling, Bacteria.

Public health officials and water well drillers discuss their experiences and opinions concerning organic drilling fluids. Several states have regulations concerning their use or are in the process of investigating them. Many problems in organic-drilled wells may result from a driller's unsanitary drilling procedures or failure to follow manufacturer's instructions. Helpful suggestions are provided for safe and effective use of organic drilling fluids. If time and effort are spent on these precautions, organic drilling fluids can be a valuable tool, saving the driller much time and money and resulting in easier development and increased well yields. (See also W79-06897) (Purdin-NWWA)
W79-06898

ECONOMIC ANALYSIS, ROOT CONTROL, AND BACKWATER FLOW CONTROL AS RELATED TO INFILTRATION/INFLOW CONTROL,
American Public Works Association, Chicago, IL.
R. H. Sullivan, R. S. Gemmell, L. A. Schafer, and W. D. Hurst.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-280 738, Price codes: A06 in paper copy, A01 in microfiche. Final Report No. EPA-600/2-77-017a, December 1977. 110 p, 17 fig, 13 tab, 17 ref. 803151.

Descriptors: *Sewers, *Sanitary sewers, *Economics, *Infiltration, *Inflow, *Root systems, *Gates, Repairing, Maintenance, Rehabilitation, Pipes, Inspection, On-site investigations, Cities, Joints(Connections).

A compilation of needed information for local authorities and consulting engineers on the control and elimination of infiltration/inflow (I/I) flows to sanitary sewer systems is presented. The present practices for determining and controlling I/I are identified and analyzed, and the role of roots and tide or backwater gates in the I/I problem is investigated. On-site investigations and questionnaires revealed that local authorities were just beginning to consider their I/I problems. It was found that roots were a major sewer system problem. Tide gates, considered satisfactory, generally receive infrequent maintenance and often do not close properly. Since it is seldom cost-effective to correct all points of infiltration and some types of inflow, only major conditions should be corrected before determining the economics of rehabilitation versus transport-treatment. Correction of inflow conditions is generally dependent upon the political support of community leadership. Many of the factors important for economic analysis are specific to the site, and therefore the sample calculations developed herein should be used only as a guide. Water conservation devices such as flow-reducing shower heads and lavatory fixtures may be cost-effective when costs for the entire system are considered. This study updates a similar effort conducted in 1970. (Davison-IPA)
W79-06952

CONTROL OF SEWER OVERFLOWS BY POLYMER INJECTION,
Dallas Water Utilities Dept., TX.
R. W. Chandler, and W. R. Lewis.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-272 654, Price codes: A09 in paper copy, A01 in microfiche. Report EPA-600/2-77-189, 1977. 169 p, 47 fig, 16 tab, 53 ref, 5 append.

Descriptors: *Sewers, *Overflow, *Polymers, *Flow characteristics, *On-site tests, Flow rates, Friction, Performance, Costs.

Certain water soluble chemicals were injected into sewers to reduce turbulent friction. The friction-reducing chemicals prevented or limited overflows in a working sewer line when an automatic injection system was used. Three methods of polymer feed control were studied: constant rate, flow proportional, and level proportional. Constant rate is the simplest and least expensive and was adequate under most conditions. Polymer dosages directly from the dry material were in the range of 15 to 50 ppm. These are lower dosages than previously used; thus, polymer injection may be more economical than previously believed. Two problems which limited the success of the method were instrumentation failures and polymer lumping. Polymer lumping has been solved by redesigning the polymer feed funnel to incorporate a trap for lumps. The two polymer types tested were: Union Carbide Polyox WSR-301 (polyethylene oxide) and ICI America 4430 (polyacrylamide copolymer). Friction reducing properties were similar, but differences in mixing properties existed. The ICI polymer had a wetted specific gravity greater than 1.0, which produced some polymer accumulations near the bottom of the mixing tank. In this case, mechanical agitation would make the injection rate more constant. (Small-FRC)
W79-06973

SEWER INFILTRATION AND INFLOW CONTROL PRODUCT AND EQUIPMENT GUIDE,
American Public Works Association, Chicago, IL.
W. S. Foster, and R. H. Sullivan.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-272 680, Price codes: A05 in paper copy, A01 in microfiche. Report EPA-600/2-77-017C, 1977. 78 p, 50 fig, 7 ref, 1 append.

Descriptors: *Sewerage, *Inflow, *Infiltration, *Flow measurement, *Pipes, *Monitoring, Safety, Sanitary engineering, Inspection, Maintenance, Mechanical equipment.

New and existing equipment, materials, and practices available to prevent the infiltration and inflow of water into sewer systems are listed and discussed. Sewer cleaning techniques and equipment needed to help locate points of infiltration and inflow and to improve the accuracy of inflow measurements, are described. A review is presented of the flow-measurement equipment and techniques necessary for the determination of the quantity of infiltration and inflow. Equipment and practices used to inspect sewers and locate entry points of unwanted water are also reviewed. These include closed-circuit television, photographic inspection, low-pressure air testing, and smoke inspection. Current sewer-grouting practices, equipment, and material are discussed with emphasis on acrylamide gel and the elastomeric grouting compound. A review is presented of insertion pipe for rehabilitation, sewer fittings, and a brief discussion of trench backfilling monitored by nuclear soil-density meters. Safety practice, which should be followed when crews undertake control of sewer infiltration and flow, are discussed. (Small-FRC)
W79-06980

8B. Hydraulics

A SUMMARY OF INTERACTING, SURFICIAL GEOLOGIC PROCESSES AND POTENTIAL GEOLOGIC HAZARDS IN THE NORTON BASIN, NORTHERN BERING SEA,
For primary bibliographic entry see Field 5B.
W79-06516

TWO-DIMENSIONAL SHALLOW WATER-WAVE MODELS,
Louisville Univ., KY. Dept. of Civil Engineering.
N. Katopodes, and T. Strelkoff.
Journal of Engineering Mechanics Division, American Society of Civil Engineers, Vol 105, No EM2, Proceedings Paper 14532, p 317-334, April 1979. 8 fig, 1 tab, 23 ref, 2 append.

Descriptors: *Waves(Water), *Shallow water, *Flood waves, *Model studies, Mathematical models, Equations, Unsteady flow, Flow, Numerical analysis, Analytical techniques, Hydraulics.

For two-dimensional unsteady flow in shallow water, real characteristic surfaces exist. Their envelope is a quadric conoid, whose curvilinear rays serve as paths for the transmission of information in t-x-y space. The original equations of flow can be reduced along these rays, called bicharacteristics, to equations containing differentiation in one less direction. Simplified numerical methods can be developed, utilizing this property of the equations, that are superior to both finite difference and finite element techniques. Three numerical characteristic networks of varying complexity were tested for accuracy and stability with flow problems that involve both subcritical and supercritical flow. The solution proceeds in specified time intervals by extending the bicharacteristics backwards until they intersect a plane on which the flow conditions can be found by interpolation from known data. The most accurate numerical network was applied to the computation of a highly two-dimensional wave propagating on a dry bed. (Sims-ISWS)
W79-06588

FRICTION FACTORS FOR CORRUGATED PLASTIC DRAINAGE PIPE,
Guelph Univ. (Ontario). School of Engineering.
R. W. Irwin, and J. Motycka.
Journal of the Irrigation and Drainage Division, American Society of Civil Engineers, Vol. 105, No. IR1, Proceedings Paper 14424, p 29-36, March 1979. 6 fig, 9 ref, 1 append.

Descriptors: *Pipe flow, *Plastic pipes, *Friction, Turbulent flow, Hydraulics, Plastics, Flow, Drainage, Turbulence, Graphical analysis, *Drainage pipes, Friction factors, Corrugated pipes.

The hydraulic roughness of 200-mm, 250-mm, and 300-mm corrugated plastic drainage pipe was measured. The Darcy-Weisbach friction factor and the Manning roughness factor, respectively, are as follows: 200 mm = 0.082 and 0.019; 250 mm = 0.068 and 0.018; and 300 mm = 0.095 and 0.022. A graph for pipe diameter selection for a choice of slopes was included. (Lee-ISWS)
W79-06608

FLOW PAST BODIES IN A TURBULENT FLOW NEAR A SOLID SURFACE,
Akademiya Nauk SSSR, Moscow. Inst. Vodnykh Problem.
For primary bibliographic entry see Field 2J.
W79-06612

FLOW IN A BEND IN A ROTATING OPEN CHANNEL,
Bergen Univ. (Norway). Geophysical Inst.
G. K. Furns.
Journal of Hydraulic Research, Vol. 17, No. 1, p 15-22, 1979. 5 fig, 3 ref.

Descriptors: *Open channels, *Flow, *Hydraulics, Eddies, Viscosity, Coriolis force, Equations, Mathematical studies, Rotational flow, *Rotating open channel, Rossby number, Secondary flows.

A constant flow down a circular bend in a rotating open channel of rectangular cross-section was considered. By using the eddy viscosity concept combined with a finite slip velocity at the bed, simple analytical solutions of the problem were obtained. They showed a helical motion induced by the combined effects of channel curvature and Coriolis force. For values of the inverse Rossby number close to zero, we have the well known secondary flow away from the center of curvature near the surface and towards it near the bottom. As the inverse Rossby number increases, the secondary flow is strengthened or weakened, depending on the relative direction of rotation of the basic flow. The basic flow also was shown to be strongly influenced by the inverse Rossby number. (Lee-ISWS)
W79-06759

CHESAPEAKE BAY FUTURE CONDITIONS REPORT, VOLUME 12, APPENDIX 16: HYDRAULIC MODEL TESTING,
Army Engineer District, Baltimore, MD.
For primary bibliographic entry see Field 6G.
W79-06795

ANNOTATED BIBLIOGRAPHY ON NORTHERN ENVIRONMENTAL ENGINEERING 1976 - 1977,
Department of Fisheries and Environment, Ottawa (Ontario).
B. C. Armstrong, and J. J. Cameron.
Economic and Technical Review Report EPS 3-WP-79-1, January 1979, 132 p.

Descriptors: *Bibliographies, *Environmental engineering, *Water, *Waste water(Pollution), *Air pollution, *Solid wastes, Utilities, *Environmental conditions, *Northern Areas.

To aid individuals concerned with or working on environmental engineering projects in northern areas, the Northern Technology Unit (NTU) has undertaken a program of preparing biennial bibliographies of environmental engineering reports and papers. This publication is the second in the series, the first of which was the 1974-75 edition, published March, 1977 as Environmental Protection Service Report No. EPS-3-WP-77-6. Only reports and papers which are generally available are included in either of these report listings. The NTU will not function as a distribution source for the reports listed in the bibliographies. There are three distinct parts to this document. The first, the annotated bibliography itself, has been arranged alphabetically by first author. The article summaries were either prepared by the NTU or extracted from published abstracts. The second part, the keyword index, is also in alphabetical order and was based on terms commonly used or appearing in similar engineering or environmental bibliographies. Included in the keyword index are special topic keywords relating to water, wastewater, air pollution, solid waste, environmental conditions

and utilities delivery to provide faster access to the references by subject area. The third part of the document is the special bibliography of conferences and other bibliographies which may be of interest to the user. This latter section was not limited to the 1976-77 period. (WATDOC)
W79-06847

LOCATION OF MUNICIPAL WELL FIELDS IN AN ENVIRONMENTALLY SENSITIVE REGION,
Geraghty and Miller, Inc., Tampa, FL.
For primary bibliographic entry see Field 6B.
W79-06855

8C. Hydraulic Machinery

WATER SYSTEMS BASICS--PART IV.
Ground Water Age, March, 1979. p 17-19, 3 fig, 3 tab.

Descriptors: *Pumps, *Electrical wiring, Jets, Submersibles, Installation.

Selection criteria for water pumps include cost, performance, noise, well depth and other advantages and disadvantages. Shallow-well jet, deep-well jet, and submersible pumps are compared using these criteria. Pump installers should make sure that overload protection is provided and that the wire from the control box to the pump is of adequate size. The size wire needed depends on the power requirements of the pump and the length of the wire run. A lightning arrester should be added if it is not included with the basic pump package. (Purdin-NWWA)
W79-06899

WATER SYSTEMS BASICS--PART V.
Ground Water Age, Vol. 13, No. 8, p 17-19, 36, April, 1979. 2 fig.

Descriptors: *Jets, Installation, Pumps, Shallow wells, Deep wells, Sites, Well data, Pipes, Pumping.

Basic procedures and guidelines for jet pump installation are outlined. The location for the jet pump should be stable, sanitary, protected, and as close to the well as possible. Well capacity and other data should be determined from a well log or pump test. The size of pipes, whether steel or plastic, should never be reduced below the pipe size of the ejector and the pump body. Essential pipe fittings include unions, gate valves, and tees. For shallow wells the maximum suction lift cannot exceed 25 feet. A foot valve prevents water in the suction pipe from flowing back into the well. A well seal is installed at the top of the casing. After surface connections are made the pump must be primed before operating. Deep well jet installation can be a two-pipe or single-pipe system. In the single pipe system, the casing acts as the drive pipe. Air pumping in underproductive wells can be avoided with a tailpipe which decreases the flow as the water level in the well falls. (Purdin-NWWA)
W79-06900

A COMPARISON BETWEEN EXPERIMENTAL AND NUMERICAL INVESTIGATIONS OF THE MOTION OF THE WATER SURFACE IN A MODEL SURGE TANK,
University of Wales Inst. of Science and Technology, Cardiff. Dept. of Civil Engineering.
P. W. France.
Advances in Water Resources, Vol. 1, No. 1, p 49-51, September 1977. 3 fig, 4 ref.

Descriptors: *Surge tanks, *Motion, *Water surface, *Behavior, Comparison, Computer programs, Finite difference procedure, Unsteady flow, Equations, Hydroelectricity, Pipelines, Flow rate, Reynolds number.

This paper describes an investigation into the motion of the water surface in a simple model surge tank and the relevant factors governing its behavior. The oscillation of the free water surface is an unsteady flow problem which is amenable to a mathematical solution using a finite difference step-by-step integration procedure. For comparison, two such methods are presented: (1) a simple initial value method; and (2) a predictor-corrector technique. Computer programs have been developed linked to a graph plotter to give a visual presentation of the numerical solutions together with the experimental results of the damped oscillation of the water surface in the model surge tank. (Bell Graf-Cornell)
W79-06923

8E. Rock Mechanics and Geology

HYDROGEOLOGICAL TESTING ASSOCIATED WITH UNDERGROUND COAL GASIFICATION,
Alberta Research Council, Edmonton. Ground Water Div.
R. I. J. Vogwill.
Canadian Geotechnical Journal, Vol. 16, No. 2, p 59-68, February, 1979. 7 fig, 2 tab, 9 ref.

Descriptors: *Coals, *Aquifer testing, Aquifer characteristics, Permeability, Storage coefficients, Anisotropy, Confined aquifers, Fracture permeability, Canada.

Four aquifer tests were conducted near Forestburg, Alberta to determine aquifer characteristics of a coal seam and surrounding sediment, examine surface-groundwater relationships, and establish whether the permeability of the coal seam was anisotropic. The results of these tests were to aid in the evaluation of the effects of underground coal gasification on the groundwater regime. Two pre-gasification tests indicated that the coal seam was a confined aquifer with a small storage coefficient and limited, anisotropic permeability that appeared to be unrelated to regional fracture patterns. The influence of this anisotropy on controlling the directions of gasification was not established due to uncertainty about the consistency of coal fracturing. The first post-gasification aquifer test indicated that the groundwater regime had changed somewhat. Groundwater temperatures increased from 6 degrees C to 30 degrees C. Permeability increased and had a more pronounced anistropy. Gasification was thought to have increased the porosity of the coal which resulted in a 20-fold increase in the storage coefficient. Subsequent excavation of the coal confirmed this assumption. The second post-gasification test indicated that fracturing in the coal seam was inconsistent and that major axis of anisotropy and the direction of regional major fracturing coincide. (Purdin-NWWA)
W79-06806

8G. Materials

THE ORGANIC DRILLING FLUID CONTROVERSY: PART I,
For primary bibliographic entry see Field 8A.
W79-06897

8I. Fisheries Engineering

DISTRIBUTION OF INSHORE FISHES AT CANTON ATOLL,
Naval Undersea Center, Kailua, HI. Hawaii Lab.
For primary bibliographic entry see Field 2L.
W79-06886

9. MANPOWER, GRANTS AND FACILITIES

9B. Education (In-House)

U.N. GROUND WATER PROGRAM.
Water Well Journal, Vol. 33, No. 6, p 68, June, 1979.

Descriptors: *United Nations, *Foreign countries, *Water supply development, Ground water, Projects, Programs, Training, Exploration, Drilling, Governments, Research and development, Water resources development, Geologic formations, Geographic regions.

The U.N. ground water exploration and development program has substantially benefited 57 developing countries by improving rural and urban economies, increasing agricultural production and alleviating water shortages. Current projects include surveys of ground water resources, organization of ground water services, and water resources policy and planning. These projects are designed to satisfy a variety of water supply needs in different geographic and geologic areas. Financial and human resources contributed to the project by the host government are commensurate with the country's economy. Most U.N. projects have included on-the-job training using a variety of drilling rigs, and analytical and surveying equipment. (Purdin-NWWA)
W79-06707

9C. Research Facilities

RESULTS OF LYSIMETER TRIALS AT THE LIMBURGERHOF FACILITY 1927-1977; THE MOST IMPORTANT FINDINGS FROM 50 YEARS OF EXPERIMENTS,
Badische Anilin-und Soda Fabrik A.G., Ludwigshafen am Rhein (Germany, F.R.). Landwirtschaftliche Versuchsstation.
For primary bibliographic entry see Field 2G.
W79-06746

10. SCIENTIFIC AND TECHNICAL INFORMATION

10B. Reference and Retrieval

HYDROLOGY OF LAKES IN THE MINNEAPOLIS-SAINT PAUL METROPOLITAN AREA: A SUMMARY OF AVAILABLE DATA STORED--USING A DATA-BASE MANAGEMENT SYSTEM,
Geological Survey, St. Paul, MN. Water Resources Div.
For primary bibliographic entry see Field 2H.
W79-06815

10C. Secondary Publication And Distribution

ANNOTATED BIBLIOGRAPHY FOR WATER QUALITY MANAGEMENT, FIFTH EDITION.
Environmental Protection Agency, Washington, DC. Water Planning Div.
For primary bibliographic entry see Field 5G.
W79-06715

THIRD ANNOTATED BIBLIOGRAPHY ON BIOLOGICAL EFFECTS OF METALS IN AQUATIC ENVIRONMENTS (NO. 1293-2246),
Environmental Research Lab., Narragansett, RI.
For primary bibliographic entry see Field 5C.
W79-06866

10D. Specialized Information Center Services

IRRIGATION DATA BASE FOR ARIZONA,
Sandia Labs., Albuquerque, NM.
For primary bibliographic entry see Field 6B.
W79-06564

INTERNATIONAL FIELD YEAR FOR THE GREAT LAKES.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-282 462, Price codes: A07 in paper copy, A01 in microfiche. Report No. IFYGL Bulletin (Special) No. 22, March, 1978. Proceedings, IFYGL Wrap-Up Workshop, Geneva Park Conference Centre, Longford Mills, Ontario, Canada, October 2-5, 1977, 150 p, 13 fig, 1 tab, 349 ref, 4 append.

Descriptors: *International Hydrological Decade, *Conferences, *Lake Ontario, *Canada, Water balance, Lake morphology, Boundaries(Surfaces), Air-water interfaces, Turbulent boundary layers, Energy budget, Meteorology, Evaporation, Biology, Chemistry, Lake basins, Watersheds(Basins).

A wrap-up workshop was attended by 61 scientists who participated in or contributed to the International Field Year for the Great Lakes, a joint U.S.-Canadian field study of Lake Ontario and its basin. The panel discussions were organized to critically assess the following programs: terrestrial water balance, lake meteorology, atmospheric boundary layer, energy balance, evaporation synthesis, water movements, and biology and chemistry. The reports vary as to content and emphasis because each panel had a slightly different interpretation of its role. (Davison-IPA)
W79-06874

10F. Preparation Of Reviews

GROUND-WATER COMPUTER MODELS--STATE OF THE ART,
Camp, Dresser and McKee, Inc., Champaign, IL. Water Resources Div.
For primary bibliographic entry see Field 2F.
W79-06595

A SPECIAL REPORT: GROUND WATER INDUSTRY LEADERS.
Ground Water Age, p 34-51, December, 1978.

Descriptors: *Water wells, *Surveys, *Drillers, *Water systems, Gross income, Industries, Personnel.

A survey of the ground water industry's leaders in the United States ranks leading contractors, wholesalers, and water system specialists by dollar volume. Key personnel, major equipment owned, wells drilled, pumps installed and major areas of activity are listed. Wholesaler listings include major water systems product lines and gross volume. All firms were asked the same survey questions. Some, however, elected not to answer one or more of the questions such as annual gross dollar volume. Some firms preferred not to be included in the survey. (Purdin-NWWA)
W79-06706

OIL/WATER SEPARATION: STATE-OF-THE-ART,
Rutgers - the State Univ., New Brunswick, NJ. Dept. of Chemical and Biochemical Engineering.
For primary bibliographic entry see Field 5D.
W79-06775

PROCEEDINGS OF THE BI-STATE CONFERENCE ON THE CHESAPEAKE BAY APRIL 27-29, 1977,
For primary bibliographic entry see Field 6B.
W79-06778

PROCEEDINGS, FIFTH UNITED STATES/JAPAN CONFERENCE ON SEWAGE TREATMENT TECHNOLOGY,
Environmental Research Center, Cincinnati, OH.
For primary bibliographic entry see Field 5D.
W79-06779

SHORELINES MANAGEMENT '77: PERFORMANCE AND PROSPECTS.
Washington Univ., Seattle. Div. of Marine Resources.
For primary bibliographic entry see Field 6G.
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BIOLOGICAL IMPLICATIONS OF METALS IN THE ENVIRONMENT.
For primary bibliographic entry see Field 5B.
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W79-06996	5E
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SOURCE	ACCESSION NUMBER	TOTAL
A. CENTERS OF COMPETENCE		
Colorado State University, Irrigation Return Flow Quality	W79-06547--06557 06642, 06647 06691--06694 06696--06698 06700--06705 06708 06710--06713 06715, 06736	33
Cornell University, Policy Models for Water Resources Systems	W79-06648--06649 06669--06689 06728 06796--06803 06809--06811 06861 06919--06939	57
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Franklin Institute (FIRL), Municipal and Industrial Wastewater Treatment Technology	W79-06506--06509 06534, 06540 06541, 06545 06546, 06562 06569, 06584 06955--06957 06959--06982 06984--06987 06989--07000	55
Illinois State Water Survey, Hydrology	W79-06503 06585--06619 06643--06646 06650--06662 06695, 06699 06723 06725--06726 06737--06770 06877--06890	106

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SOURCE	ACCESSION NUMBER	TOTAL
A. CENTERS OF COMPETENCE (CONTINUED)		
Institute of Paper Chemistry, Water Pollution from Pulp and Paper Industry	W79-06620, 06722	2
National Water Well Association, Water Well Construction Technology	W79-06706--06707 06709, 06714 06724, 06735 06792 06804--06808 06843, 06855 06862--06864 06870 06895--06913	37
University of Arizona, Arid Land Water Resources	W79-06832--06842 06844--06846 06860	15
University of N. Carolina, Metropolitan Water Resources Planning and Management	W79-06531--06533 06535--06539 06542--06544	11
University of Wisconsin, Eutrophication	W79-06504	1
University of Wisconsin, Water Resources Economics	W79-06727	1
B. STATE WATER RESOURCES RESEARCH INSTITUTES	W79-06501--06502 06558 06729--06734 06856 06892--06894 06914--06918	18
C. OTHER		
Environment Canada (WATDOC)	W79-06847--06854	8
Environmental Information Services, Inc. (Effects of Pollutants on Aquatic Life)	W79-06716--06721	6

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SOURCE	ACCESSION NUMBER	TOTAL
C. OTHER (CONTINUED)		
Information Planning Associates, Inc.	W79-06560--06561 06563--06568 06570--06583 06771--06791 06793--06795 06865--06869 06871--06874 06876 06940--06954	71
National Oceanic and Atmospheric Administration	W79-06505, 06690	2
Ocean Engineering Information Service (Patents)	W79-06621--06641	21
Ocean Engineering Information Service (Outer Continental Shelf)	W79-06510--06529 06663--06668	26
Office of Water Research and Technology	W79-06559 06858--06859 06891	4
U. S. Geological Survey	W79-06812--06831	20

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SOURCE	ACCESSION NUMBER	TOTAL
A. CENTERS OF COMPETENCE (CONTINUED)		
B. OTHER (CONTINUED)		
Institute of Paper Chemistry, Water Pollution Problems in the Pulp and Paper Industry	W79-06620, 06722	
Information Planning Associates, Inc.	W79-06560--06583	71
National Water well Association, Water Construction Technology	W79-06706--06707 06709, 06714 06724, 06735 06792 06804--06808 06843, 06855 06862--06864	
National Oceanic and Atmospheric Administration	W79-06605, 06690 06670 06825	2
Ocean Engineering Information Service (Patents)	W79-06633--06634 06844--06846 06860	21
Ocean Engineering Information Service (Outer Continental Shelf)	W79-06531--06532 06535--06539 06542--06544	26
Office of Water Research and Technology	W79-06504	4
U. S. Geological Survey	W79-06727	20
B. STATE WATER RESOURCES RESEARCH INSTITUTES	W79-06501--06502 06559 06729--06734 06866 06892--06894 06914--06918	
C. OTHER		
Environment Canada (WATDOC)	W79-06847--06854	
Environmental Information Services, Inc. (Effects of Pollutants on Aquatic Life)	W79-06716--06721	